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Editorial Notes

Making and Selling

"THE Gas Industry is a coal processing industry in which the aim is to convert it into products of the maximum financial value, cheap gas being the primary objective." This, to our mind happy, definition of the purpose of our Industry was given a year ago by Dr. E. W. Smith in a discussion at a meeting of the Society of Chemical Industry, and on the same occasion Dr. Smith pointed out that 85% of the population of this country is dependent on incomes of £5 a week and less. In other words, the future of the Industry must depend on how well it can cater for the masses. The object must be cheap gas, and this in spite of the fact that nowadays the public demands not gas but the service which gas can perform, and the public's expectations of this service daily become more exacting. It has been stressed lately that we must not be content to give a supply of gas which is adequate in volume and does not fail; we need to supply gas which does not vary in quality. Research directed to this end is being carried out under the auspices of The Institution of Gas Engineers. Technically there would be no difficulty in supplying a gas of unvarying quality. It is simply a matter of economics, and we think that what we should find out is what degree of variation is allowable. We should like to hear a great deal more from the supply side of the Industry of the difficulties which are actually encountered throughout the country with the present gas supply, and how many of the difficulties are in fact isolated examples the cause of which can readily be traced and can at a price—not necessarily an unduly high one—be remedied.

Considering the complexity of the gas making process, the cost at which gas of reasonably constant quality can be put into holder is, we suggest, commendably small. A far better gas supply than formerly is being made at no greater cost into holder. The efficiency of gas manufacture is exceedingly high, though we would be the last to say that it has reached perfection. The quality of the gas made is such that many former troubles on the district have been eliminated, and there is no doubt that the quality, in regard to sulphur content, for example, will be improved. It is difficult to foresee, however, any reduction in cost of manufacture which will have a marked bearing on the price at which the consumer can be supplied. Turning to the latest edition of Field's Analysis we find that in 1936 the Gas Light and Coke Company had a net coal cost of 1·125d. per therm and a figure for total manufacturing costs of 1·586d.—of which, 1·064d. represents wear and tear—a total cost of 2·7d. per therm. A 20% reduction in the cost of manufacture would represent, then, about a halfpenny per therm. As comparison the costs of manufacture in 1930 were 2·424d. per therm, and net coal cost was 1·486d.—a total of 3·9d. per therm. Substantial economies in manufacture have, therefore, been effected.

Distribution costs have in the meantime increased. With the new housing developments, with fewer consumers per mile of main, this, of course, was inevitable. The figures of dustry is far better than it was even a decade ago. are respectively 2·616d. and 3·308d. per therm. We quote these figures not with the idea of referring specifically to the Gas Light and Coke Company, but as some index of the trends of costs in the Gas Industry generally. The service which the customer now receives at the hands of the Industry is far better than it was even a decade ago. Hundreds of thousands of new appliances have been installed many of which, such as automatic water heaters, are as a matter of course regularly serviced. The number of fitters, salesmen, and canvassers has been raised, as also has the standard of their craftsmanship and work. Research into the problems of utilization of gas, comparatively new, is now quite extensive. These developments have been rendered necessary by changing conditions and increasing competition, and the Gas Industry would have been more than foolish if it had not tackled the problem of giving good service, ensuring the satisfaction of the consumer, wholeheartedly and with determination. But it all costs money. Savings on the manufacturing side, and improved manufacturing processes, have done something to offset the growing expenditure on "service." In regard to processes we may cite the removal of naphthalene from gas—a riddance which must have released for more remunerative work a whole army of fitters and maintenance men. The point we would raise, however, is whether service costs are swelling out of proportion to the costs of manufacturing the product which the salesman has to persuade the public to use.

"Free" Service

WOULD it not be salutary if we paused for a moment to take stock of the situation, with an eye on the difference between the cost of the therm into holder and the price of the therm at the consumer's burner? Has not the time come when we should seriously ask ourselves whether there will

not have to be some limit placed to "free" service, lest gas develops more and more into a luxury product? Details of manufacturing costs are scrutinized with eagle eye. Are the costs of supply and service similarly examined? No one will—or should—gainsay the fact that good service is imperative to-day, but this does not imply that the same careful thought should not be exercised in regard to service costs and the gaining of new business as is given to manufacturing costs. Are we, in brief, being carried a little too hastily on the tide of service enthusiasm?

The solution to the problem, it will be suggested—and with good reason—lies in one direction only, to increase the consumption per consumer, thereby spreading the costs entailed in distribution and selling over a greater volume of business. This can only be done, however, by low prices for added consumption. Some risk is attached to the offer of low-price gas, but it will have to be taken; and encouragement can be had from the experience of those undertakings which already have proved the advantages of adopting a two-part tariff or some alternative method of charge which in effect amounts to the same thing. We appreciate fully that the best time to introduce a two-part tariff or its equivalent is when, with falling costs, it would in any case become possible to reduce the flat-rate charge. Unfortunately the present is a time of rising costs—dearer raw materials, higher labour charges. Even so, we cannot see the Gas Industry going ahead if it adheres to the flat rate and takes no steps to introduce optional systems of charge by which alone it can secure the substantial—and it must be substantial—increase in consumption per consumer which is its aim. It needs courage, admittedly, but the only alternative we can see is loss of business on the flat rate. Nor in saying this are we unmindful of the fact that in the long run the increased gas consumption which is legitimately to be expected as a result of the operation of a two-part tariff will necessitate the installation of further gas-making plant, and that the two-part tariff should be regarded as a means of reducing the cost of the therm at the outlet of the holder, and not a means of lowering the cost of the therm into holder—at any rate to any appreciable extent. We are writing this in no pessimistic vein. We are simply attempting to analyze the situation as we see it. More and more is the public demanding labour-saving cooking, heating, and water heating equipment, and there is a growing and a real demand for smokelessness. The extent of the field which lies before the Gas Industry is immense; for its exploitation low-price gas is essential, and the corollary to this is the two-part tariff, which in its turn must be expected to bear the cost of the service and salesmanship which are needed under the conditions of to-day.

200 B.Th.U. Gas

In an article bearing the title "The Future Orientation of the Gas Industry," which we published in the "JOURNAL" for Jan 5, a contributor discussed the economic possibilities of producing and distributing a low grade gas having a calorific value of the order of 200 B.Th.U. per cu.ft. The article was written in a spirit of enquiry, and it has aroused renewed interest in a subject which has been a matter of controversy for years. It is good that from time to time we should have our thoughts stimulated, that we should consider with an open mind possible, if revolutionary, changes which might ultimately benefit our Industry. That, we know, was in the mind of the Author of the article in question, but it is to be doubted whether the contribution, interesting as it is, has in fact carried us much further towards the goal of cheaper gas.

The Author began his article by discussing the extent of the field which lies before the Gas Industry and the price at which gas would have to be supplied to capture this field. The field is, of course, the huge one of entirely replacing raw coal by gas; and it was suggested that if a large proportion—say, 75%—of the coal now used for household purposes could be converted to gas, the Gas Industry would become four times its present size, irrespective of what was done in the industrial gas field. It is a glowing prospect. An interesting analysis followed of the relative costs of the useful therm in the form of coal and in the form of gas, and it is concluded that, if house coal costs 30s. a ton, gas must be sold at 3·6d. a therm, and that if coal costs 50s. a ton gas could be sold at 6d. a therm. We think these costs constitute a reasonable basis for attack on the problem.

The next step the Author took was to consider the cost of gas into holder, and he reproduced authoritative figures given to The Institution of Gas Engineers by Mr. E. G. Stewart and by Mr. R. W. Hunter, of the Gas Light and Coke Company, and published in the Institution's Transactions. These figures, which relate to the cost of gas production in horizontal retorts, continuous verticals, intermittent verticals, and coke ovens, were substantiated with clarity and in great detail. He also cited published figures of other undertakings of various sizes, selected at random, and in different parts of the country. The broad conclusion was drawn that it does not seem safe to assume that the Gas Industry as at present constituted can produce purified gas, including capital charges on manufacturing plant, management, and so forth, at a figure less than 2·75d. per therm.

The Author then asked whether there is not some simpler method of making gas, and explained that an examination of the possibilities had led him to the view that an internally heated low-temperature retort *plus* a producer gas generator, the two forming a single unit, would be the simplest and cheapest of all. Without substantiating his assumption by fact or figure, he put forward the statement that "in a plant of this type working under reasonable average conditions the cost of making 200 B.Th.U. purified gas into holder is of the order of 1d. per therm . . . under really favourable conditions costs can be still lower." The Author quite obviously will not expect gas engineers to accept this statement, unsupported as it was by any evidence; his idea of the care required in arriving at costs of gas manufacture is well evidenced by his reference to the work of Mr. Stewart and Mr. Hunter. An important point, however—it was made in a letter published in our issue last week—must be stressed. It is unlikely that suitable slightly-caking coal could be delivered in London at a cost below that of the coals at present being carbonized in "orthodox" plants. This means a coal cost alone—assuming a production of 180 therms per ton—of 1¼d. per therm in the plant advocated by the Author. It may be of interest if we quote the figure given by Mr. Hunter for the cost of producer gas made in mechanical producers at Beckton with small coke at 15s. per ton and breeze at 5s. per ton. This was 1·26d. per therm. The main theme of the Author was to consider what extra costs would be involved in distributing low-grade gas if—an all-important "if"—it could be made at 1d. per therm; and the figures of transmission costs which he submitted will, we think, prove a useful reference.

The merit of flexibility of the plant he favours was emphasized by the Author of the article. It is so flexible, he stated, that additional gasholder capacity would be unnecessary. Gasholder capacity is, however, linked up with the

problem of gum formation—a point upon which the Author did not touch. Nor did he mention the important aspect of the size of purifying plant which would be needed for dealing with a gas of volume 2½ times that at present being generally supplied. Then, of course, one has to bear in mind the millions of pounds of capital expended on equipment suitable for the gas now supplied and unsuitable for gas having a calorific value of 200 B.Th.U. per cu.ft. There is no need to elaborate this consideration.

We have been critical of the article on "The Future Reorientation of the Gas Industry." None the less, it was a thought-provoking contribution. We want to see an inroad made into that portion—and it is a large portion—of the domestic heating load which is at the moment the preserve of raw coal. If a new gas-making process were developed which could be shown substantially to lower the cost of gas production and to be capable of being economically applied practically, the Gas Industry, in its own interests and those of its consumers, would not be slow to take advantage of it.

Gloucester's Public Lighting

In the "Journal" for Oct. 13 last we referred in these columns to an application by the Gloucester Corporation to the Ministry of Health to borrow £16,000 for the purpose of public lighting. The application was concerned with the proposal of the City Council to substitute electricity for gas in those streets at present lighted by gas. At the enquiry held by the Ministry the Town Clerk explained that the Council was convinced that electricity was a better form of lighting than gas for streets, and that the policy of the Corporation for a great many years had been to eliminate gas for street lighting. The Corporation, he added, had their own electricity undertaking, and the matter was always in their own hands. As large ratepayers the Gloucester Gas Light Company very rightly opposed the Corporation's application, and the enquiry brought to light a state of affairs not uncommon where local authorities own the electricity undertaking and where the gas undertaking is company-owned. During the course of the enquiry the City Engineer and Surveyor agreed that the comparative figures laid before the Highways Committee were made up from an out-of-date gas lighting system and up-to-date electric lighting.

The Gloucester Gas Company contended that the proposed expenditure was unjustified in that it would impose an unnecessary charge on the ratepayers with no corresponding advantage, and that the Corporation, without incurring such expenditure, could have the streets as well lighted by gas as by electricity. We now learn with satisfaction that the Ministry of Health has suggested to the Council that the two competing interests should be afforded an opportunity of demonstrating how they would deal with streets coming within the category of Group B in the Final Report of the Ministry of Transport Departmental Committee on Street Lighting. This suggestion was reported by the Chairman, Alderman H. G. Williams, at a meeting of the Gloucester Council. He explained that he had given an assurance that the Corporation would select a suitable street in the city and would give both the gas and the electricity undertakings full facilities for showing what they could do, and would invite the Electricity Department and the Gas Company to submit tenders for such lighting. Any decision regarding which illuminant, gas or electricity, to employ should be based on the merits of the two in relation to cost and the conditions to be fulfilled, not on blind prejudice. Alderman Williams said the Corporation wished to approach the test with open minds. We trust that this attitude will be observed—more particularly in view of the hope expressed at the meeting in question by another Alderman that the Corporation would do everything they could to see that electricity was installed.

Dry Purification

In an article on later pages Dr. F. Perna describes experiments he has carried out on the influence of time of contact of gas and oxide during the process of dry purification. The Author concludes that, while the process of purification with simultaneous revivification is dependent on the time of contact, unit volume of material purifies rather more town gas when the time is increased by reducing the velocity than for equal times obtained by increasing the depth of the oxide. The suggestion is made that a series of experiments undertaken in Great Britain using the apparatus designed by Dr. Perna might well yield information which would prove of much practical use. Dr. Perna points out that it is inadvisable to use a larger quantity of oxide than is strictly necessary. Where boxes have been built on the large side to provide for a future increase in load, only sufficient oxide should be placed in them to give the time contact necessary for the actual maximum daily load.

The Killing Mantle

The shape of the mantle and the gas burner nozzle are important factors in relation to the amount of light obtained and its distribution, and in a Paper presented to the Illuminating Engineering Society—an extract of which we publish to-day—Mr. Dean Chandler, of the South Metropolitan Gas Company, refers to this subject. Dr. Killing investigated this problem some few years ago, and his work led him to the conclusion that much was possible in this regard. He found that a particular shape of mantle, in conjunction with a nozzle the lower extremity of which extended to a point near the bottom of the mantle, gave a considerable increase in the amount of light for a given quantity of gas. Mr. Chandler is of opinion that Dr. Killing's important discovery has not received the attention it deserves. He has recently investigated Dr. Killing's views, and in his Paper gives a comparison of the results obtained with a burner and mantle constructed in accordance with Dr. Killing's suggestion with those with an ordinary burner and mantle consuming gas at the same rate and pressure. Burners are now being designed to take advantage of the valuable improvement disclosed.

The Consumer's Choice

An article which appeared in the issue of *The Economist* for Jan. 8 was concerned with the relative thermal efficiencies in use of gas and electricity, starting with raw coal as the basis. Taking into account efficiency in production, in distribution, and in utilization, the Author arrived at the conclusions that for space heating the overall efficiencies are 18·5% for gas and 18% for electricity, for water heating 20% for gas against 17·6% for electricity, and for hotplate cooking 12% for gas and 10% for electricity. "In these and similar cases, therefore," it is stated, "the superior efficiency of gas in production and distribution is almost counterbalanced by the superior efficiency in use of electrical appliances. From the purely technical point of view, the consumer is better served by electrical equipment for these purposes; but from the general economic standpoint, which concerns the community as well as the consumer, there is very little to choose between the two fuels, though the balance may incline slightly on the side of gas." We fail entirely to understand what the contributor of the article meant by "purely technical point of view." The production and utilization of gas are as technical as the production and utilization of electricity. The process of gaseous combustion is a highly technical affair. If the contributor meant satisfactory service, then, on the score of both speed and economy, gas has it every time. Again, from the national point of view, the "general economic standpoint," surely the gas making process, which entails the production of smokeless solid fuel, motor spirit, tar, and a host of secondary by-products, stands to gain in any comparison with the generation of electricity.

Leamington's Public Lighting

At a meeting of the Leamington Town Council last week it was resolved to include as an item of special expenditure in next year's draft estimates the sum of £2,500 for public lighting. When the matter was under discussion Alderman England, Chairman of the Watch Committee, mentioned that Leamington had one of the lowest rates for lighting in the country; they had, in fact, not been prepared to pay the money needed for lighting the streets to a standard adequate to meet modern traffic requirements. From the previous estimates the figure has increased by £1,200, a provision the wisdom of which was questioned at the meeting. We are sure, however, that when gas is given further opportunity of demonstrating what excellent public lighting service it can give with up-to-date equipment, Leamington ratepayers will be well satisfied in the result. At present, all Leamington public lighting, with the exception of a little ornamental electric lighting, is by gas supplied by the Leamington Priors Gas Company, all the fittings being owned by the Corporation. In relation to the expenditure, highly satisfactory service has been consistently given. Even the best of illuminants, however, cannot be expected to fulfil all the exacting requirements of modern traffic—and Leamington is a difficult place in which to drive—unless sufficient flux of light is purchased and this flux is applied to the best advantage. We think that the ratepayers of Leamington will be agreeably surprised at the improvement which is bound to result from the extra expenditure.

New Form of Competition

In the annual report of the Council of the Property Owners' and Factors' Association, Glasgow, Ltd., it is stated that certain contractors are endeavouring to compel landlords in the city to agree to the installation of a supply of electricity in the houses of their tenants. The procedure adopted by these contractors is to persuade tenants to enter into a hire-purchase agreement for the installation of electricity. As soon as the agreement has been signed they install a rising main without the consent of the landlord, and thereafter wire the houses of the tenants who have signed the agreement. The next step is to ask the Electricity Department to give a supply. The Department approaches the landlord for his consent, and if the landlord's consent is refused legal proceedings are threatened by the contractors. It is not that the property owners have fault to find with the tenant's freedom of choice. Any wiring, however, they maintain, should be carried out in a manner satisfactory to the landlord, who should definitely be approached in the first instance. This seems to us only reasonable. It is a new form of competition when a "contractor" comes along to a tenant, boosts electricity, and endeavours to get a signature on a hire-purchase agreement for wiring; and we are glad to note this protest against the practice.

Comparative Costs of Cremation

Data on the relative costs of cremation by gas and electricity are given by "Hotspot" in the *Electrical Times* for Jan. 13. He quotes the figures set out in a report of the Tunbridge Wells Burials Board Committee to the Town Council recommending the installation of an electric furnace, costing £1,800, at a new crematorium to be built at Ashby's Farm. Tenders for gas and electric plants were considered. The total estimated cost of the gas furnace (including cost of gas main and electricity service) was £797 and the operating costs were estimated at 7s. 7d. per cremation with gas at 9d. per therm for the first 125 therms per quarter, 8½d. for the next 125, 8d. for the next 250 therms, and 7½d. per therm for excess consumption. The cost of gas is worked out on the assumption that 2,000 cu.ft. would be required per cremation, and the full price of 9d. per therm has been taken. The figure of 2,000 cu.ft. is definitely on the high side. We have before us figures relating to the Manchester Crematorium showing an average of less than 600 cu.ft. for three cremations carried out on the same day. As mentioned, the cost of the electric furnace was estimated at £1,800, the supply and laying of a high-pressure cable to the site being undertaken free by the Electricity Department. The supply terms offered—with the proviso that no cremation takes place after 3.30 p.m. during the months of November, December, January, and February—were either 12s. per cremation or ½d. per unit. We do not think we are far wrong in suggesting that electricity will prove twice as expensive as gas for the purpose. That, presumably, was why it was recommended. And this apart from a capital cost more than double that of a gas installation.

Gas Lighting in Churches

The Gas Industry should take note of a resolution passed by a Committee set up by the Society for the Protection of Ancient Buildings to investigate whether or not gas lighting was in any way damaging to either ancient or modern churches. The Committee was set up as a result of an allegation in the 6th Report of the Central Council for the Care of Churches that gas caused damage. The Committee, upon which the Royal Institute of British Architects was represented, held several meetings, attended by many experts, and collected a great deal of information. The case for gas was put before the Committee by Mr. J. G. Clark, Technical Adviser to the British Commercial Gas Association. At the final meeting the following resolution, which completely vindicates gas lighting, was passed:

"Having regard to the number of churches lighted by gas and the fact that no specific evidence of damage has been brought to their notice, despite enquiries in various directions, the members attending this Conference consider that, whatever may have been the case in the past, no reason has been brought forward to suggest that, under present conditions, at all events, gas lighting is harmful to the fabric of churches. It is the opinion of the members that the standard of purity imposed by the statutory requirements together with the efficient combustion of modern gas lighting appliances, and their proper maintenance, are adequate safeguards against any risk of damage."

Forthcoming Engagements

January

20.—**S.B.G.I.**—Council Meeting, 2.30 p.m.
22.—**Wales and Mon. Jnrs.**—Meeting at Abertillery. Paper by H. T. Maycock, "Reconstruction of Abertillery Gas-Works;" and Visit to Works.
22.—**Western Juniors.**—Meeting at Weston-super-Mare. Paper by A. G. Holtham, "Rural Gas Services."
26.—**B.C.G.A.**—Annual Meeting of Members in Northern District, Newcastle-upon-Tyne, 3 p.m.
27.—**Midland Juniors.**—Visit to Docker Bros., Paint and Varnish Manufacturers, Birmingham.
27.—**Southern Association of Gas Engineers and Managers (Eastern District).**—Meeting at Gas Industry House, 2.30 p.m. Discussion on "Some Notes on Works Practice." Committee, 12 noon.
27.—**B.C.G.A.**—Annual Meeting of Members in South Wales District, Cardiff, 3 p.m.
28.—**I.G.E.**—Liquor Effluents and Ammonia Committee, 11.15 a.m.; Joint Research Committee, 2.30 p.m.
29.—**Scottish Western Juniors.**—Visit to Glasgow Corporation Lighting Department.

(There will be no meeting of the Central Executive Board of the National Gas Council or of the Central Committee of the Federation of Gas Employers during the month of January.)

February

1.—**I.G.E.**—Research Executive Committee, 2.30 p.m.
1.—**B.C.G.A.**—Annual Meeting of Members in South-Western District, Exeter, 2.30 p.m.
2.—**London and Southern Juniors.**—Visit to Watson House.
3.—**Midland Juniors.**—Meeting and Paper by G. Bakewell, of Birmingham, "The Sale of Coke for Domestic Purposes."
3.—**B.C.G.A.**—Annual Meeting of Members in Midland District, Birmingham, 2.30 p.m.
5.—**Scottish Eastern Juniors.**—Short Paper Meeting at Dunfermline.
5.—**Manchester and District Juniors.**—Meeting at Blackpool. Paper by T. V. Blake, "A Six Years' Period Prior to the Removal of Blackpool Gas-Works."
7.—**London and Counties Coke Association.**—Technical Committee, Gas Industry House, 2.30 p.m.
8.—**I.G.E.**—Finance Committee, 10 a.m.; Membership Committee, 11 a.m.
10.—**B.C.G.A.**—Annual Meeting of Scottish Members, North British Station Hotel, Edinburgh, 2.30 p.m.
12.—**Scottish Western Juniors.**—Meeting and Paper by E. Smith, of Dumbarton, "Stores Control and Job Costing."

February 21-March 4.
British Industries Fair, Castle Bromwich.

Feb. 24.—Joint Visit of Junior Gas Associations.
Feb. 25.—Joint Visit of B.C.G.A. Salesmen's Circles.
Feb. 28.—Visit of Women's Gas Council.
Mar. 1-3.—Joint Gas Conference.

Obituary

R. W. EDWARDS, J.P.

The death occurred on Saturday last, at the age of 66, after a period of failing health, of Reginald William Edwards, Chairman and Managing Director of the Mid-Southern Utility Company and Chairman of the Gas Companies' Protection Association.

Born and educated at Wallasey, Mr. Edwards was identified with the gas undertaking there, serving for ten years under Mr. J. Ashton Hill and also with the latter's successor, Mr. J. H. Crowther. He joined the Aldershot Gas, Water, and District Lighting Company as Secretary in the year 1899, becoming General Manager in 1905. In 1917, he was appointed Managing Director, and, in 1919, Chairman of the Company on the resignation of Mr. W. T. Robertson.

Under Mr. Edwards' able guidance, the Aldershot Undertaking made enormous progress; several Acts of Parliament concerning the purchase of other companies, the extension of the gas and water works, the distribution of electricity over a large area, and considerable additions to the limits of supply were secured during his tenure of office. The 1931 Act enabled Associated Utilities, Ltd., which was formed by and under the control of the Mid-Southern Utility Company, to obtain control in various gas and electricity companies, among which are the Basingstoke Gas Company, the Kingsclere Gas Company, and the Reading Gas Company.

In March, 1924, on the completion of a quarter of a century with the Company, Mr. Edwards was the recipient of a handsome presentation from his co-Directors and employees. He not only successfully conducted the affairs of the Company for so many years, but at all times took the greatest interest in his workpeople; he was mainly instrumental in founding the co-partnership fund and was always respected for his absolute justice and fairness—ever ready and willing to give of his advice and assistance and to offer a helping hand to any of the staff who had fallen on hard times.

An active member of the Gas Companies' Protection Association for many years, Mr. Edwards was latterly officially identified with its work, being elected Deputy Chairman in November, 1920, at the time when Dr. Charles Carpenter took over the Chairmanship on the resignation of Mr. H. E. Jones. In 1929 he became Chairman of the Association, since when his comprehensive reviews, at successive Annual Meetings, of that organization's activities on behalf of company owned gas undertakings have been regarded as an index of the Industry's progress.

For many years Mr. Edwards was prominently associated with local government. He was elected Chairman of the Health Committee of the Aldershot Borough Council in 1928, having been a member of the Royal Institute of Public Health since 1913. He also received the signal honour of being elected Mayor of the Borough on three successive occasions—in the years 1929, 1930, and 1931. He was elected a County Councillor, representing the East Ward of the Borough of Aldershot in 1931. His interest in local affairs was further evidenced in 1933 when he presented a silver challenge cup to the Aldershot County High School on the occasion of its 21st birthday in remembrance of the happy and successful years his daughter spent there.

In 1914 he made a valuable contribution to the records of the Industry by presenting a Paper, entitled "Business Building," before the Southern District Conference of the British Commercial Gas Association.

He was actively associated with the work of the national organizations of the Industry, being a member of the Central Executive Board of the National Gas Council and of the Committees of the British Commercial Gas Association and the British Gas Federation, as well as on the Committees of the British Waterworks Association and the Water Companies' Association.

A keen Freemason, Mr. Edwards was a Founder and P.M. of Palma Virtuti Lodge, No. 4187, and was, in July, 1929, invested P.G.S.D. of Hampshire and the Isle of Wight, at a time when he was in office for the fourth year as D.C. of his Mother Lodge.

In the passing of Mr. Edwards the Industry has lost a tireless and conscientious worker on its behalf, and the sympathy of his many professional colleagues will be extended to his family in their sad bereavement. The interment took place at the Wimborne Road Cemetery, Bournemouth, at 1.30 p.m. yesterday, and a Memorial Service was held at the same hour at Holy Trinity Church, Aldershot.

Mr. PETER GREENOUGH, who died a few days ago, at Hindley Green, had been Gas and Water Manager for the Hindley U.D.C. since April, 1925. He had longer service than any other employee of Hindley Council, starting as a boy of thirteen at the Council's Gas Undertaking under Mr. Dickinson in July, 1891.

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Mr. HENRY SIMMONDS, for thirty-eight years the Engineer and Manager of the Bury Corporation Gas Department, died at his home, Elton View House, Bury, on Jan. 14, at the age of 73. Since his retirement at the end of 1935, Mr. Simmonds had not been in good health. Prior to his appointment at Bury in 1898, when he was 34 years of age, Mr. Simmonds held a similar position at Colne for several years.

Personal

Mr. A. R. THOMAS is now a Partner in the firm of Messrs. Thos. Bugden & Co.

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Mr. J. ERIC PALMER has joined the Board of Directors of the Watford and St. Albans Gas Company to fill the vacancy caused by the death of Mr. R. T. Kent.

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Mr. A. COLLINSON, Distribution Superintendent to the Darwen Gas Department, has been appointed to a similar position with the Peterborough Gas Company.

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Mr. R. E. WILES, who has been Engineer and Manager of the Heckington Gas Company for five years, has been appointed Engineer and Manager of the Castletown Water Company, Isle of Man.

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Mr. FRANK B. ALLEN, Secretary of the Farnworth and Kearsley Gas Company, retired at the end of last year. He had held the position since 1931, and had been in the service of the Company for nearly forty years.

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Mr. MAURICE H. THORNTON, a Director of Richmonds Gas Stove Company, Ltd., was recently entertained by the London Officials and Staff, when a presentation was made to him on the occasion of his leaving London for Warrington, where the General Offices and Works of the Company are situated.

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Mr. GEORGE LINDLEY, Engineer and Manager of the Dukinfield Gas Department, has just completed forty years' service in the Department. The Town Council has placed on record that he "has carried out his duties with credit and to the satisfaction of the Council." Mr. Lindley commenced his career under the late Mr. Harrison Veevers.

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Mr. WILLIAM J. WHYTE has retired after thirty-seven years' service at Seaham, twenty of which were spent as Assistant Manager and seventeen as Manager. His father, the late Mr. James Whyte, was Manager for forty-seven years, holding office from the formation of the Company in 1873 until 1920. Since the amalgamation of Seaham Company with Sunderland Gas Company in October, 1936, he had continued to act as Manager at Seaham.

Leverhulme Research Fellowships, 1938

Application is invited for (i) Fellowships or (ii) Grants in aid of research. The Fellowships or Grants are intended for senior workers who are prevented from carrying out research work by routine duties or pressure of other work. They are limited to British-born subjects normally resident in Great Britain. In exceptional circumstances the Trustees may waive the condition as to residence.

The duration of the awards will not normally extend over more than two years or less than three months and the amount will depend on the nature of the research and the circumstances of the applicant. Any subjects which may add to human knowledge may be proposed for a Fellowship or Grant, but preference is given to subjects in which other provision for research is inadequate.

Forms of application may be obtained from the Secretary, Dr. L. Haden Guest, Leverhulme Research Fellowships, Union House, St. Martin's-le-Grand, London, E.C. 1.

Applications must be received on or before March 1. Awards will be announced in July and the Fellowships or Grants will date from Sept. 1, 1938.

Letters to the Editor

"The Nature of Coal"

SIR,—The article under the above heading in your issue of Jan. 12, while rightly appreciative of recent American researches, seems not only to overlook the fundamental pioneering work of British laboratories on the chemical constitution of coal, but to suggest that nothing comparable with American work has been accomplished here. Thus, for example, when your article says that while "hitherto the constitution of coal has been examined by subjecting a wide range of coals to a standard procedure" the "subjecting one coal to every conceivable chemical and physical process that seems likely to yield any useful information . . . seems to be employed only at one place—the Coal Research Laboratory of the Carnegie Institute of Technology . . . (where) . . . the elucidation of the chemical constitution of the selected coal has been attacked by the three methods of oxidation, halogenation, and hydrogenation," it implies that while British investigators have applied but one experimental procedure to many coals, their American *confrères* have shown better judgment in subjecting one coal to many different procedures, and with more fruitful results—which, to say the least, is very misleading.

On the contrary, it might be said more truthfully that while British investigators have tried out many reagents and methods of attack, they have concentrated upon those which preliminary search had shown to be most suitable and promising, and have applied them systematically to a selected range of typical coals representative of all the great geological epochs (carboniferous, mesozoic, and tertiary). And it seems to me that, in some respects, such plan is preferable to that said to have been adopted at the Carnegie Institute. Indeed the methods cited in your article as having been employed on "the selected coal" at the Carnegie Institute (*i.e.*, oxidation, halogenation, and hydrogenation) had been employed and standardized in this country for years past, and were subsequently adopted in America.

Thus, for example, more than twenty years ago workers in my research laboratory at the Imperial College, London, were brominating bituminous coals, finding that the halogen acts upon them by "substitution" as well as by "addition" and "adsorption," and that stable brominated products, outwardly resembling the original coal, result without any breakdown of its essential molecular structure. Moreover, during 1929-33, A. McCulloch published extensive experiments upon the chlorination of coals, showing that "addition" at unsaturated linkages occurs followed by "substitution," though not within the fundamental benzenoid nuclei. And it does not appear to me that recent American experiments get much further.

Again, as regards oxidation, as far back as 1920 F. Fisher and Schräder in Germany were obtaining small yields of benzenoid acid by oxidizing bituminous coals with air at atmospheric pressure; and in 1925 W. Francis and R. V. Wheeler, in Sheffield, obtained small quantities of such acid by oxidizing "regenerated ulmins from coal" by means of 30% nitric acid. In 1925, also, at the Imperial College, London, we discovered that the "residues" from the benzene-pressure extractions of coals can be so oxidized by boiling alkaline permanganate as to yield carbonic anhydride, acetic, oxalic, succinic, and nearly the whole series of possible benzene carboxylic acids in large quantity; and later we adapted and standardized an experimental procedure so as to enable the whole carbon-distribution among the various oxidation products to be quantitatively determined. And by means of such standardized procedure we have been able not only to prove the essential benzenoid structure of the main coal-substance, but also to trace its progressive development in the lignin → peat → coal → anthracite series; which latter could never have been done had we, like the Americans, confined our experiments to a simple selected coal. Finally, we were able to show the quantitative effect of coal-carbonization up to 1,000° C. upon the benzenoid structure of the resulting coke.

Your article credits the Carnegie Institute investigators with discovering "a surprising contrast between the apparent physical heterogeneity of coal and its chemical homogeneity"; but previously we had proved that, on oxidation with boiling alkaline permanganate under like conditions, both the "bright" and the "dull" constituents of bituminous coals ("vitrain" and "durain") yield practically the same proportions of carbonic anhydride, acetic, oxalic, and benzene carboxylic acids. And other of the American results and conclusions have been more or less anticipated here.

The matter could be pursued further, were it necessary or profitable to do so; but perhaps enough has been said to vindicate British coal research, and to deprecate comparisons as being both invidious and misleading. Adoption of our experimental procedure by American investigators and their substantial agreement with our conclusions are welcome endorsement of our work.

Our American *confrères* may be congratulated upon the splendid financial support given by American industrial firms and organizations to the work of the Coal Research Laboratory of the Carnegie Institute of Technology since it was opened 7½ years ago. To read about its annual income of £16,000 being already assured until the end of 1940 makes one's mouth water. Their financial resources are more than ten, and their "man-power" about eight times, ours. We are thankful for what we do receive, and (as the hymn says) "would humbly ask for more."

Yours, &c.,
WILLIAM A. BONE.

Imperial College of Science and Technology,
South Kensington, S.W. 7,
Jan. 14, 1938.

[The purpose of the editorial comment to which Prof. Bone refers in his letter was to call attention to the investigation at the Coal Research Laboratory of the Carnegie Institute of Technology and in particular to the support it is receiving financially from industry. It was certainly not our intention to ignore the vast amount of pioneering research undertaken in British laboratories on the chemical constitution of coal, in which work Prof. Bone and his collaborators have played such a valuable and prominent part. We are happy to publish Prof. Bone's letter, which shows so clearly that we are in no way lagging behind in fundamental research on coal in this country.—Ed., "G.J."]

Salaries of Gas Engineers

SIR,—I see in your issue of Jan. 12 that two undertakings are advertising for the services of a gas engineer. The first is for a 60 million works and the salary is £300 rising in two years to £400 per annum; the second asks for the services of a "competent Engineer" and offers £300 rising to £400.

I think these salaries are not likely to attract young men to the Industry, and they are, to me, a very poor reward for the energy and time that must be spent in order to become efficient.

Perhaps the time is ripe for the Gas Industry to consider whether it should emulate the electrical industry and formulate a scale of salaries for engineers and managers.

Yours, &c.,
C. S. SHAPLEY,
Engineer and General Manager.

City of Leeds Gas Department,
Market Hall, Leeds, 2,
Jan. 13, 1938.

Women's Gas Council

Domestic Services Exhibition.

A Domestic Services Exhibition and Conference is being held at the Royal and New Horticultural Hall, Westminster, from Jan. 15 to 21. The Exhibition was opened on Jan. 15 by Miss Thelma Cazalet, M.P., and an interesting Conference has been arranged at one session of which a member of the Women's Gas Council will talk on "What to Eat, and Why."

There are discussions between mistresses and maids on the servant problem, talks on how to run a house properly with one, two, or three servants, and in the section entitled "Use of Leisure" there are talks on the facilities offered by various organizations such as the Girls' Friendly Society, Girl Guides, Y.W.C.A., and the L.C.C. Women's Institutes. In connection with the exhibition there is a series of competitions for cooking, valeting, table-laying, and other domestic duties, and the Women's Gas Council is organizing the judging of the cookery competition for the candidates who choose to cook by gas. This competition consists of the preparation in three-quarters of an hour of a "scratch" meal from ingredients provided.

The Women's Gas Council is represented on the Council of this exhibition by Miss K. M. Halpin, Organizing Secretary, and plans have been formulated by which the Women's Gas Council co-operate with the organization in the new scheme which they are drawing up for starting centres for training girls for domestic service.

Women's Advisory Housing Council.

The fact that Miss K. M. Halpin, Organizing Secretary, the Women's Gas Council, has been co-opted to the Executive Committee of the Women's Advisory Housing Council is a recognition of the growing importance of the Council, whose increasing membership provides an excellent means of ascertaining the views of a large number of women on housing questions generally.

News of the Week

A New Showroom is being built by the Chertsey Gas Consumers' Company at Addlestone, Surrey.

The Index of the "JOURNAL" for the quarter October to December, 1937, appears as a supplement to this issue.

A Motion that electric light be installed in the Council Chambers was defeated by the Carnoustie Town Council on Jan. 10.

An Increase, estimated at over 6%, in the output of gas during 1937 is reported by the Bedford District Gas Company.

An Extension of the Gas-Works at an estimated cost of over £40,000 is under consideration by the Largs Town Council.

Sanction to Borrow £11,500, being the amount in excess of £60,000 in respect of the cost of the erection of a new gasholder, is to be sought by the Birkenhead Council.

An Increase of 1 million cu.ft. in the output of gas during December as compared with the corresponding period of last year is reported by the Wrexham Gas Company.

The Summary of Current Literature on Water Pollution Research, Vol. XI., No. 1, January, has been published by the Department of Scientific and Industrial Research, and is obtainable from H.M. Stationery Office, price 2s. net.

The Acquisition of a Site at the corner of High Street, Doncaster Road, Oswalf Road, and Froadingham Road upon which to erect joint gas and electricity showrooms and a central public library is being planned by the Scunthorpe Borough Council.

Three Days After the Town Council had decided to complain of frequent interruptions in the electrical supply, there was a failure at Montrose which lasted for forty-five minutes. Other centres affected were Arbroath, Brechin, Carnoustie, Monifieth, and Forfar.

Coal Tar Distillation and Road Tar will be the subject of a Paper by Mr. W. Kirby, B.Sc., A.I.C., of the South Metropolitan Gas Company, to be read before the Society of Chemical Industry at the Technical College, Cathays Park, Cardiff, on Jan. 20. Members of the Gas Industry are cordially invited to attend.

The Silver Medal of the Junior Institution of Engineers has been awarded to Mr. G. H. Rogers and Mr. J. E. Gray, of the Mains Department of the Gas Light and Coke Company, for a Paper entitled "The Laying and Maintenance of Gas Mains in Congested Areas." The Medal was presented by Sir William Larke.

Application for a Special Order, under the Gas Undertakings Acts, 1920 to 1934, is intended to be made to the Board of Trade by the Portsmouth and Gosport Gas Company with the object of empowering the Directors to appoint one of their body as a Managing Director and to make provisions as to his term of office, remuneration, and powers.

At the British Empire Exhibition to be held at Glasgow, the Women's Gas Council has been allotted space in the Cultural Section of the Women's Pavilion, and a small Sub-Committee is designing a modern kitchen where an expert on kitchen planning will give advice on all household problems. There will be, in addition, an information bureau for general enquiries regarding the work of the Women's Gas Council.

The Lighting Committee of Middlesbrough Corporation have, on the recommendation of Superintendent of Street Lighting, ordered that all future installations of street lighting shall be planned to conform with the recommendations both for Group A and Group B of the Final Report of the Departmental Committee of the Ministry of Transport on Street Lighting.

Book Matches are now obtainable from the B.C.G.A., bearing new illustrations and slogans, including the addition of a slogan on the inside cover. Supplies of these matches are immediately available at the usual prices, as follows: 39s. per 1,000; 77s. per 2,000; 110s. per 3,000; 144s. per 4,000; and 175s. per 5,000. The minimum order is 500 books for 22s. The usual charge of 2s. 6d. is made to cover cost of special packing and carriage on orders of less than 2,000 books. Provision is again being made for special matter to be printed on the inside covers in place of the standard overprinting, which can be arranged at the following additional rates: 10s. per 1,000; 15s. per 2,000; 16s. 6d. per 3,000; 18s. per 4,000; and 20s. per 5,000.

In a Supplement to the *Western Mail*, Mr. H. D. Madden, M.Inst.C.E., M.I.Mech.E., Engineer and Manager of the Cardiff Gas Light and Coke Company, contributed an article on the Gas Industry and the coal trade. There was also another article dealing with street lighting and road safety, in which it was pointed out that all the recommendations contained in the Final Report of the Departmental Committee of the Ministry of Transport can be simply and efficiently met with gas.

Sales of Appliances at Burnley last year created a record. The total sales, amounting to £38,922, give an average of £1 3s. 9d. for every consumer. The sales over the past five years reached the total of £174,910. Gas is laid on to all the housing schemes in Burnley, enabling the tenants to continue to use the service to which they have been accustomed. Gas sold for industrial purposes in Burnley increased during the year by 22%, and the proportion of gas now used for industrial purposes is equal to 20% of the total output.

Two Further Lectures were given to the outdoor staff of the Sheffield Gas Company on Jan. 13 and 14 by Mr. W. H. G. Davy, B.Sc., Technical Assistant of the Parkinson Stove Company, Ltd., Stechford, at the Barnsley and High Street showrooms, Sheffield. Mr. Davy's most instructive talks dealt with modern cooker design, with special reference to the "Renown" cooker. There was an average attendance of fifty persons at the lectures and at the close of each session a good discussion followed. Mr. Davy showed an interesting series of lantern slides.

The Value of Gas Cooking was stressed by the Mayor of Stockton (Councillor J. Wilyman) when he attended the first of a series of demonstrations given by the Corporation Gas Department in the Eastbourne Estate Hall. He drew attention to the fact that there were 23,452 gas cookers in use in the Stockton area. The demonstration was given by Miss C. Wood, of the Department's staff. Others present were Mr. W. W. Atley, Engineer and General Manager, and Mr. L. Coulson, Distribution Department, who was responsible for the demonstration.

Two Motor Cars Collided on a slippery road surface outside the large central showrooms of Bradford Corporation Gas Department on Jan. 10. One of them careered across the footway and shattered a large plate glass window of the showrooms and demolished a good deal of the marble surround. The Department seized its opportunity. The annual "sale" was in progress, and the same day's evening newspaper contained a large photograph of the smashed window frontage, with the top and bottom captions: "Don't be Late for our Annual Sale, but—Please Park your Cars *Outside*. Take advantage of the Smashing Bargains at the Bradford Gas Department Showrooms, Britannia House."

An Enquiry was held by Mr. G. H. Pritchard at the Town Hall, Hunstanton, on Jan. 10, to consider an application by the Hunstanton Urban Council to the Ministry of Health for consent to a loan of £6,000 for a new gasholder. Mr. W. H. Ward, Clerk, explained that the Council had two gasholders. The demand for gas had increased considerably recently, and during peak hours it was very difficult to maintain pressure. There was an outstanding loan due to be paid off this year and a new loan would mean practically no increase in the rates. Mr. F. Wilkinson, Engineer and Manager, said that with the coming of electricity the Council had withheld extension of mains to Heacham, but now there was an agitation in that district for gas.

Institution of Gas Engineers

B.S. Specifications

Copies of the following recently issued British Standard Specifications may be obtained from The Secretary, The Institution of Gas Engineers, 1, Grosvenor Place, S.W. 1.: No. 759-1937. Valves, gauges, and similar fittings for land boiler installations (price 2s.) and No. 761-1937. Cylindrical vertical multitubular boilers (price 3s. 6d.).

Examination Dates

Examinations in Gas Engineering (Manufacture) will be held on April 30 and those in Gas Engineering (Supply) on May 7. Oral examinations will be held on June 29. Results will be published on July 20.

Athletic and Social

New Year Party at Gas Industry House.

Gas Industry House was put to a new use last Saturday evening, when the "Tenants' Association"—comprising the various organizations whose headquarters are at No. 1, Grosvenor Place—held their first New Year Party. And a most enjoyable event it was, too, indicating in another way, perhaps, the internal solidarity of the Gas Industry. Moreover, it enabled many people who had not hitherto had the opportunity of viewing the Industry's fine new building to do so under novel conditions.

Among those present we noticed prominent figures from the various National Bodies, including Dr. W. T. K. Braunholtz and Dr. W. E. le B. Diamond (of The Institution of Gas Engineers), Mr. W. J. Smith (of the National Gas Council), Mr. W. D. Rowe and Mr. P. J. Lucas (of the British Commercial Gas Association), Mr. W. L. Boon (of the London and Counties Coke Association), and Miss K. M. Halpin (of the Women's Gas Council).

In addition to dancing in the large committee room—and we assure the committees who meet there from time to time for more serious purposes that it makes a first-class dance floor—there were some amusing "side-shows" and competitions in an adjoining room. During an interval in the dancing Derek Oldham rendered a number of songs which were greatly appreciated, while a conjuring entertainment added to the enjoyment of the evening. Nor must we forget to mention a clever display of tap-dancing by a lady member of the staff of the London and Counties Coke Association. There was whist for those who preferred it in the quarters of the Women's Gas Council, while the main entrance hall was put to good use in being converted into a running buffet.

The function was an undoubted success from the word "go," and in congratulating those responsible upon the excellent organization of the evening, we would reiterate the hope expressed by the two hundred or more persons present that it will be the precursor of many similar annual events.

Leicester Carnival Ball.

About six hundred people attended the first carnival ball of the Leicester Gas Department, held at the Palais de Danse, Leicester, on Jan. 13.

The event was organized by Mr. Leslie Bray (Secretary) and a Committee comprising Messrs. Jennings, Rogers, Fiddes, and Walter Bray, and Miss Whitmore. Mr. Kenneth Holyoake, as "Mr. Therm," a mystery man, gave the dancers a lively hunt before he was found.

Those present included Alderman E. Grimsley, Chairman, and Members of the Gas Committee, and Mr. J. Mitchell, Engineer and Manager.

Children's Party at Cambridge.

About 100 children met for the annual party given by the Recreation Club of the Cambridge University and Town Gas Light Company. After a tea, in the serving of which the wives of members rendered invaluable assistance, the young guests were entertained with a conjuring and ventriloquial performance, which was greeted with vociferous applause. Equally enjoyed was the programme of talkie films, in which Mickey Mouse played a prominent part, and other juvenile cinema fare. For a parting surprise, Father Christmas appeared and fully lived up to his reputation for jovial generosity by presenting a gift suited to each age, together with a bag of seasonable fare.

Cannon's Children's Party.

The second annual children's party for the children of employees of the Cannon Iron Foundries, Ltd., was held on Jan. 8 in the pavilion, when approximately 200 children sat down to tea.

The pavilion was suitably decorated for the occasion, and, in addition to being supplied with the usual good things, small comical hats were distributed. Mr. W. R. Hawkins, General Manager, and Mr. W. L. Johnstone, Works Manager, assisted with others in attending to the needs of the children. Tea over, the hall was cleared and the evening spent in competitions, games, and community singing. At the close of the proceedings a large Christmas tree was denuded and presentations made by Father Christmas. Needless to say, the children thoroughly enjoyed themselves and thanks were expressed to the Directors of the firm for their kindness.

Amalgamation and Grouping

Loughborough and Quorn.

Loughborough Corporation have now formally taken over the Quorn Gas Undertaking, which will receive a bulk supply in the near future.

New Books

Laboratory Manual for Gas-Works*

The manual forms one of a series of monographs devoted to the laboratory methods employed in connection with individual chemical and allied industries. The newest addition to the series is the first part of a laboratory guide for gas-works' chemists. It deals with solid and liquid raw materials and products. The second part of the manual, devoted to the examination of gases, is to be written by Dr. Hans Biebesheimer.

So far as solids are concerned, the book treats of the determination of the chemical composition of coal, the gas and coke making qualities of coal and the properties of coke, sulphate of ammonia, purifying material and refractories. As regards liquids, the materials handled comprise liquor and effluents, tar and tar products and benzole and its homologues.

In detail, the subjects cover a very wide range. Thus in the case of chemical composition, attention is first given to sampling. The determination of free and inherent moisture by oven-drying, distillation and cryoscopic methods is then described. In a section devoted to ash, the conventional process of incineration and methods for the determination of the individual inorganic impurities of coal are dealt with and information is given as to the principles involved in the calculation of the true mineral content. The chemical analysis of coal ash is also described. Subsequently, the determination of ultimate composition, total, combustible and volatile sulphur, nitrogen, oxygen, chlorides, phosphorus and metallic iron is described.

In connection with the carbonizing properties of coal the subjects about which information is given include proximate analysis, swelling characteristics, swelling pressure, agglutinating index, softening phenomena, spontaneous combustibility, permanganate number, coking heat, low and high temperature assay, complete gasification, calorific value and melting point of coal ash. The examination of coal by petrographic methods, X rays, specific gravity separation and solvent extraction complete the section.

The remaining half of the book is equally comprehensive in scope and it may be doubted whether any single publication of similar size or cost handles the subject as exhaustively as does the present small volume which, incidentally, contains 80 illustrations and very extensive and up-to-date literature references in the form of footnotes. Further references are to be found in the text in the form of appendixes to the several sections and provide information as to additional alternative methods, limits of accuracy, influence of interfering substances in determinations, &c. The manual is thus of use not only as a laboratory companion but as a valuable guide to research workers.

It is but too often the case that German text-books tend rather to do scant justice to work carried out in other countries. This charge cannot be brought against the present manual, the value of which is enhanced by the international scope of its contents.

* Laboratoriumsbuch für Gaswerke und Gasbetriebe aller Art. 1 Teil: Untersuchung fester und flüssiger Stoffe. By F. Schuster. Volume 33 of the Series of Laboratoriumsbücher für die chemische und verwandte Industrien. [Halle (Saale), 1937, Wilhelm Knapp. Pp. viii. + 168. Price RM. 12.80 bound, RM. 11.60 unbound.]

More Gas Lighting for Orpington

The Orpington Urban District Council has in recent times adopted a very progressive policy in regard to its street lighting. To-day this rapidly growing district can show some of the best examples of modern public lighting—all by gas—to be seen anywhere in the neighbourhood. This includes high-power "London" lamps on the main Hastings Road, by-pass road illumination, high-street, and secondary road lighting.

A recent order is for 121 new lamps, of which 114 have already been erected. The positioning of the new lamps is being arranged by the Council's Surveyor in co-operation with the South Suburban Gas Company.

New Showrooms for Port Talbot

Congratulations were extended to Mr. E. M. Edwards, Engineer and Manager of the Port Talbot Gas Department, and his staff, on their excellent work by Alderman Sir G. R. S. Byass, Bart., J.P., when he opened the Department's extensive new showrooms in Station Road.

Quoting figures, Sir Geoffrey spoke of the development of the Gas Industry, and said that of the 11,000 tons of coal used last year in the production of gas for the Borough, practically all the coal coming from within the district.

The new showrooms, situated on the main road, attractively display modern appliances and information.

National Fitness and Smoke Abatement

Interesting facts relative to the amenities of Kensal House from the aspect of solving the Nation's smoke problems were given by Sir David Milne-Watson in a contribution to the *Daily Telegraph and Morning Post* Supplement in support of the National Fitness Campaign published on Monday.

In recent years, said Sir David, the Gas Industry has set out to prove that a modern fuel system, with a separate living-room fire and an individual hot water supply, can be provided at a cost which is actually less than the normal working-class family pays for an obsolete heating system. It was to substantiate this point that the Gas Light and Coke Company built Kensal House, opened early last year by the Minister of Health.

Kensal House, which was fully described in the "JOURNAL" for March 24 last, is a block of 68 flats, the tenants of which were selected by the Kensington Borough Council from over-crowded areas in the neighbourhood. The kitchen of each flat has a cooker with automatic oven control, a gas water-heater supplying the kitchen and bath, a wash-copper and a gas iron. The living room is warmed by a coke fire. There are gas fires in the bedrooms and the gas lighting is controlled by switches.

The best judges of the Kensal House system are the housewives who live there. They have adjusted themselves happily to a new way of living. They say that they can finish the housework much more quickly than before. They have more time to spend with their husbands and children and friends.

It can be said at once that the cost to the tenants is on the average actually less than the normal expenditure in the same district on a very inadequate fuel service. Here are the comparative figures. The average working-class family in London spends about 6s. a week on heating, lighting and cooking. The average family at Kensal House spends a total of 4s. 4d. a week on coke and gas for all purposes. Most of the families spending 6s. a week on fuel are known to heat the living room with coal and to do part of the cooking with coal. Few have a good supply of hot water. Most have none at all. The 4s. 4d. a week spent on fuel by the average Kensal House family covers cooking by gas, clothes-washing, ironing, plentiful hot water on tap, a coke fire in the living-room, and the warming of bedrooms.

The figures given represent in each case an all-the-year-round average expenditure, taking warm and cold weather into account. The figure of 6s. a week as the average fuel bill of working-class families in London is taken from the findings of a recent investigation sponsored by the Gas Light and Coke Company; it tallies closely with the estimates which have been given by independent authorities.

This comparison means that a labour-saving and smokeless fuel equipment can be had at a fuel cost actually less than the average expenditure on an obsolete fuel system. And when fuel costs are related to the household budget as a whole, the full significance of the figure is grasped.

Lessening the Burdens of Housecraft.

In the same "National Fitness" Supplement to the *Daily Telegraph and Morning Post*, the Marchioness of Londonderry (President of the Women's Gas Council) contributed an interesting article on the use of gas in lessening the burdens of housecraft.

So long as the family remains the unit of civilized life, observed the Marchioness of Londonderry, the housewife must be the chief guardian of the Nation's health. She is responsible for laying out the family's income, for cooking the family's food, for keeping the home clean, comfortable, and healthy.

The two most important centres in the kitchen are the cooker and the sink. Unless these two centres are arranged for efficient and labour-saving working, no measures of kitchen planning can be really successful. Efficiency and economy in cooking are largely governed by the following factors: The retaining of the maximum food value, the reduction of time and work and the saving of fuel and money. On all these points the gas cooker stands very high. There has been an immense increase of efficiency—without any corresponding increase in the amount of gas used—in the gas cooker.

Automatic control of oven heat and the ease with which any heat from simmering to fast boiling is available at the turn of a tap make cooking by gas comparatively simple even for a beginner.

An automatic system of water heating raises the family's standard of living, makes cleanliness and health more easily attainable and comfort a fact, saves steps, time and work for almost every member of the family. Such a system can be and is being obtained in a growing number of working-class homes by the introduction of self-acting gas water-heaters serving bath and sink.

Finally, Lady Londonderry referred to the L.C.C. experiment which allows working-class tenants on an L.C.C. estate to hire specially designed gas refrigerators at an inclusive rental of a shilling per week. This sum covers the cost of the installation of the appliance and that of the gas used.

South London Gas Prices

Councils Object to Increase

The increase in price which came into operation on Jan. 1 for gas supplied by the South Metropolitan and South Suburban Gas Companies was discussed by the Camberwell Borough Council last week. It was decided to notify the Companies that the increase was not considered to be justified, and to ask them to submit details of the figures on which the increase is based.

Camberwell will also notify Wandsworth Council of its preparedness to join with other areas in a joint protest. Boroughs concerned include Greenwich, Deptford, Lewisham, Lambeth, Southwark, and Bermondsey.

Three councillors were appointed to attend a suggested conference of representatives from the Boroughs affected.

Meter Works Visited by Juniors

Members of the Scottish Junior Gas Association (Eastern District) visited the Works of Milne's Meters, Ltd., Edinburgh, on Saturday, Jan. 8.

The Works were in full operation, and the visitors spent two hours inspecting the manufacture of meters from the raw material to the finished article. They had also the opportunity of seeing the meters being inspected and stamped, as the Meter Testing Station had been kept open, due to the kindness of the Chief Inspector, Mr. B. King.

The members were afterwards entertained by the Directors at tea at the George Hotel, where they were welcomed by Mr. D. W. Pentland. Mr. George Braidwood, President of the North British Association of Gas Managers, was present, and gave a short Address.

The proceedings terminated with a vote of thanks to Milne's Meters, Ltd., on the proposition of Mr. A. C. Rea, President of the Association.

A Gas Cooker of 1836

The issue of the *Royal Leamington Spa Courier and Warwickshire Standard* of Jan. 14 reprints an article taken from a publication (the source is not disclosed) of 1836 in which there was a report of a lecture by Mr. James Sharp, of Northampton, delivered at Leicester before members of the Mechanics' Institution. The subject was cooking by gas, and the lecturer "described the apparatus before his audience, first pointing out the boiler, containing four gallons of water, which was kept at a boiling point by a ring of gas flame underneath, scarcely half an inch in height. On each side of the boiler was a capacious steamer, in one of which Mr. Sharp announced his intention of cooking a salmon, a plum pudding, a piece of bacon, and a fowl, adding that each should have its genuine flavour when cooked, neither tasting nor smelling of the other kinds of food.

"This was doubtless a startling assertion, and he hoped they would defer their judgment till the close of the lecture, when he intended to serve up supper to as many as would honour him with their company. His steamers being in immediate connection with the boiler, very little condensation water collected; and there being no medium to convey the flavour was the reason that the different articles of food were untainted. The boiler would also supply hot water for all purposes; and on the top, several small saucepans were arranged for preparing sauces, boiling eggs, &c. The roasting apparatus consisted of a tin case about four feet high by two feet square, with a door opening in front. At the bottom was a circular row, about 15 in. in diameter, of gas burners, over the centre of which a leg of mutton was roasting, and at the top was an oven containing an apple pie. By his plan, the meat neither required turning nor basting, owing to the facility of regulating the heat; the dripping, too, was most valuable, on account of its purity, and would always pay for the gas consumed in cooking.

"One of the advantages of gas was that the fire could be regulated to the greatest nicety by increasing or diminishing the supply of gas at the turncock. Cooking by gas requires no attention; the cook knowing at what hour she wanted the dinner to be ready, and how long each dish would take to do, had only to put down each dish at a proportionate hour, after which she might go out, and lock up the house, until the hour of taking up the dinner. By this means one person could prepare a large dinner without assistance, which rendered cooking by gas very advantageous for large establishments."

That gas was speedy and economical in those early days of the Industry is evident from the following:

"Mr. Sharp also exhibited a small apparatus with three different reservoirs for heating water, beer, wine and other liquids, by which a glass of cold water was raised to 111 degrees of heat in five seconds, according to the watch of one of the spectators. The gas flame which heated it was almost invisible, and cost only one halfpenny for 12 hours' constant burning."

Experiments in the Process of Dry Purification

by

Dr. F. PERNA

From a series of experiments the Author concludes that, while the process of purification with simultaneous revivification is dependent on the time of contact, unit volume of material purifies rather more town gas when the time is increased by reducing the velocity than for equal times obtained by increasing the depth of the oxide.

Despite the many decades during which ferric oxide compositions have been the principal means of removing sulphuretted hydrogen from town gas, the state of the subject of the rational design of suitable purifying plant may still be described as chaotic. The literature is comparatively small, and though individual contributions have generally been excellent in themselves, many of the recommendations differ so widely as to make it a matter of considerable difficulty to select with confidence a basis suitable for any particular case. A criterion suggested by earlier writers was the apparent velocity of the gas through the purifier boxes. Thus Kunath[1] recommended 16 mm. per sec. (3 ft. per min.) for fresh and 5 mm. per sec. (1 ft. per min.) for used oxide. Merz[2], however, and after him Bössner[3] directed attention to the more fundamental importance of the time of contact between the gas and the purifying material. The form in which it is now usual to express the requirements of a purifier—namely, by stating the volume of purifying material spent in the whole system for a given quantity of gas per day or per year—is essentially a statement of a time of contact.

A number of the values which have been recommended as bases for the design of purifiers in Germany, Great Britain, the U.S.A., and France—the majority in comparatively recent technical literature—have been summarized in Table 1. For the sake of comparison, the figures quoted by the various authorities have been reduced to the common basis of the amount of oxide required per 1,000 cu.ft. of gas purified per day, and hence in certain instances the originals, which are not always stated in ways that permit of direct comparison, are represented only approximately by the values given in the table. Hunt's rule, for example, states the area of boxes required per ton of coal carbonized per maximum day, and the corresponding amount of oxide shown in the table is calculated on a gas yield of 15,000 cu.ft. per ton. The rule of 1½ to 2 cwt. of oxide per box per 1,000 cu.ft. of gas per day, quoted by Alwyne Meade, has been converted for the purpose of the table on the assumption that the bulk density of the oxide is 40 cu.ft. per ton. Alwyne Meade's own rule refers to the area of the boxes, and is represented by the figures in the third column.

Clayton, Williams, and Avery state a time-contact ratio in terms of the number of cubic feet passing per hour through one cubic foot of oxide in one box. They suggest this ratio should be 12 to 15 in order to obtain a 55 to 60% sulphur content in the spent material, and the figure ascribed to them in the table is based upon this suggestion. But they point out that in modern British practice the usual ratio is 25 to 30, representing half the tabulated amounts. They found, however, ratios as low as six and as high as sixty. Masse and Baril merely state a time of contact of 6 to 7 min.

The empirical formula proposed by the Steere Engineering Company[16], popular in the U.S.A., makes some allowance for varying conditions by taking into consideration the concentration of sulphuretted hydrogen in the gas. "Proteus"[12] suggested a rational method of designing purifiers by means of a formula which expresses the relation between the four relevant variables which it is possible to represent mathematically—namely, the time of contact (expressed as the volume of purifying material, R in cu.ft., per 1,000 cu.ft. of gas per hr.), the percentage, F, of active iron oxide in the material, the density, W, of the material in lb. per cu.ft., and the number, S, of grains of sulphuretted hydrogen per 100 cu.ft. of the unpurified gas. The equation is expressed

$$R = \frac{4{,}050}{FW}\sqrt{S}$$

—the constant being derived from a known set of conditions established in good British practice.

From Table 1 it may be seen that while the velocities recommended, except in the case of Merz, are for the most part between 1 and 2 ft. per min., the diversity in the suggested amounts of oxide is remarkable. The relatively high values for Great Britain are ultimately attributable to the high sulphur content of British coals. At the entry to the purifiers town gas in Great Britain contains about 500 grains of H_2S per 100 cu.ft. (Hollings and Hutchison[17]), in U.S.A. about 300 grains, in France 300 to 350 grains (Masse and Baril), in Germany 175 to 300 grains, and in Czechoslovakia about the same. According to Milbourne[18], the boxes must be enlarged by 42% if the concentration of H_2S is doubled. But the diversity arises also from the differences in efficiency between various oxides, occasionally from certain limitations in the experience of the authority concerned, and from other causes peculiar to this or that case. It is, of course, obvious that the requirements of all purifiers cannot be covered by any single general recommendation. The properties of the gas and oxide concerned must be considered for each particular case. With this in view I developed a laboratory method for the determination of the time of contact required for the efficient purification of town gas, with simultaneous revivification of the oxide, and, as the result of a number of experiments, established the least quantity of purifying material required per unit volume of gas per day at the Works with which I am connected. Though I was dealing with Czechoslovakian conditions, the method and results may be of more general interest.

TABLE 1.

Authority.	Amount of Oxide in all Boxes in Cu.Ft. per 1,000 Cu.Ft. of Town Gas per 24 Hours.	Area of One Box in Sq.Ft. per 1,000 Cu.Ft. of Gas per 24 Hours.	Apparent Velocity of the Gas in Feet per Minute.
Merz[2]	4	0·45 to 0·1	1·6 to 10
Anderson[4]	7·5 to 10	0·7	1
Geipert[6]	5·6	0·6	1·2
Shäfer and Langthaler[8] ..	7·5 to 10	0·7	1
Bamag[7]	4·0	0·6	1 to 1·5
Alwyne Meade[9]	12 to 16	0·5 to 0·85	1·4 to 0·8
Hunt[9]	..	0·33 to 0·5	..
Davidson[10]	7·5 to 10	..	1
Pearson[11]	6·6 to 7·7	..	..
Clayton, Williams, and Avery[13]	11·2 to 13·8	..	..
American Gas Machinery Company[14]	5·7	0·45	1·6
Masse and Baril[15]	4·6	..	..

Experimental Determination of Time of Contact.

The apparatus is depicted in fig. 1. Unpurified gas taken from the mains after the ammonia washer is passed first through water in a Drechsler bottle to deposit any condensates present, and thence through the glass purifying vessels 1 to 4 containing the oxide described below. The stream is then directed through two further wash-bottles, the first containing a solution of cadmium acetate to take up the hydrogen sulphide not retained by the oxide, and the second containing a solution of potassium hydroxide to take up any acetic acid vapour entrained in the previous bottle. Such vapour is thus prevented from reaching a gasometer into which the gas is finally conducted for measurement.

The purifying material used was a good artificial composition obtained locally, with the following properties:

	As Received.	Air Dried.
Moisture content	38·6 %	8·63%
Loss on ignition	7·10 „	10·57 „
Insoluble residue	4·35 „	6·48 „
Iron oxide content	27·95 „	41·58 „
Number of grammes of H_2S absorbed by 100 grammes of composition	16·25	24·18

Comparison of the actual and theoretical absorption of H_2S showed that the composition as received—in which condition it was used for the experiments—contained 25·8% of active oxide. One litre, finely divided, weighed 700 grammes (44 lb. per cu.ft.).

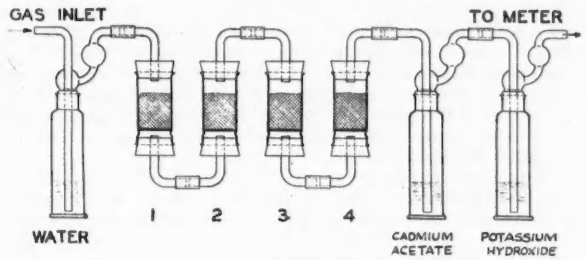

Fig. 1.

The unpurified gas contained 0·30 to 0·32% by volume of hydrogen sulphide (195-210 grains per cu.ft.); 1·4 to 1·5% by volume of air were added for the purpose of revivification, this being the amount we are accustomed to add in practice.

Since the time of contact in a vessel of a given cross-sectional area is proportional directly to the depth of material and inversely to the velocity of the gas, it may be varied by altering either or both of these factors. In the experiments the variation was effected first by increasing the depth of material in the reaction vessels in successive experiments (from 6 mm. to 12, 24, 48, and 96 mm., about $\frac{1}{4}$ in. to $3\frac{1}{4}$ in.), while maintaining a constant gas velocity of 5 mm. per sec. (1 ft. per min.), and secondly by changing the velocity (10, 5, 2·5, 1·4 mm. per sec.—2 to 0·12 ft. per min.) through a constant depth of 24 mm. (1 in.) in each vessel. Each experiment was continued until conditions in the third vessel were such as to permit the passage of sufficient H_2S to cause a blackening of the material at the bottom of the fourth. In those experiments in which the velocity was greater than 5 mm. per sec. the residual H_2S was not absorbed by the cadmium acetate solution, but was calculated from the difference between the H_2S content of the gas entering the apparatus and the quantity absorbed by the oxide.

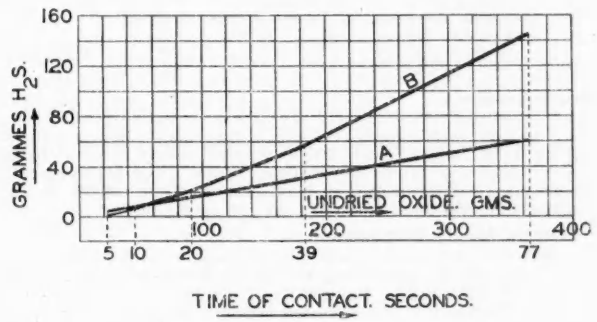

Fig. 2.

It is not proposed here to tabulate at length the details of the individual experiments, but to indicate briefly the principal results. The graph, fig. 2, brings out the influence of the time of contact on revivification. Curve *a* shows the amount of H_2S with which the undried oxide could combine without revivification, and curve *b* shows a series of the corresponding experimental results obtained when revivification was taking place simultaneously. The effects of the presence of oxygen did not become appreciable until the time of contact approached 20 sec. Times below about 10 sec. were insufficient for the complete conversion to sulphide even of the small quantity of oxide concerned.

The experiments demonstrated the paramount influence of the time of contact. Whether the gas velocity was varied or the depth of the oxide, the effects were approximately the same for equal times of contact. The velocity of the gas through the material had, however, a distinct effect, since for a given time of contact the efficiency of purification, as evidenced by the amount of H_2S left in the gas after it had passed through the apparatus, decreased for velocities greater than 5 mm. per sec. (1 ft. per min.).

In those experiments in which the velocity of the gas was kept constant for varying depths of material, which will be called group A, the maximum sulphur content reached in

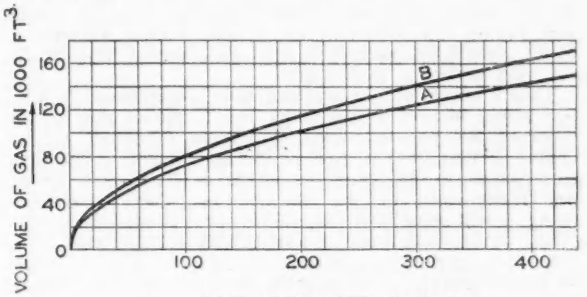

Fig. 3.

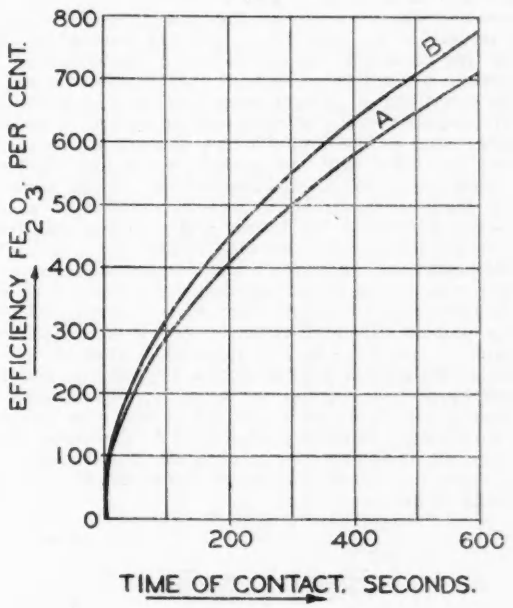

Fig. 4.

the first vessel, calculated on the dry material, was 44·7% for a total contact time of 76·8 sec. in the four. In the experiments in which the velocity was varied through a constant depth, called group B, the maximum was 42·8% for 68·5 sec. It was necessary to deduce from these results the time of contact required for the attainment of a sulphur content of 60% which is desirable in practice. To this end a number of graphs were plotted, all with the time of contact as base, showing the relation between the time and such quantities as the volume of gas purified by unit volume of the material, the sulphur content of the spent material, the efficiency of active oxide in the material, the amount of H_2S absorbed, and others. Two of the graphs, or rather of similar graphs in their extended form covering the extrapolation to which reference is made below, are shown in figs. 3 and 4. The curves were found to be approximately

parabolic in all cases. Hence it appeared justifiable to extrapolate to greater times of contact. Sight was not lost, however, of the probability of some decrease in the effectiveness of the revivified oxide with increasing sulphur content, due to the shrouding of the oxide by the freed sulphur.

Applying these observations to the problem in hand, and taking the experiments in group A successively, it was found that for every doubling of the time of contact the increase in the sulphur content of the material in the first vessel was represented by some factor between 1·15 and 1·24. For group B the factor lay between 1·15 and 1·26. In order to make an allowance for the above-mentioned shrouding effect, the lowest factor, 1·15—that is, the factor corresponding to the longest time contact for a given sulphur contact—was selected for the estimation of values above the experimental range. Purification was more complete in the A than in the B group of experiments. As previously stated, in the A group, when the contact time was 76·8 sec., the sulphur content was 44·7%. Applying the factors, sulphur contents of 51·4% should be reached in twice this contact time, or 154 sec., and of 59·1% in 308 sec.

Thus it appeared that our maximum requirements in practice would be met by designing for a contact time of the order of 308 sec.—provided, of course, the oxide was of quality similar to that used in the experiments. This time corresponds to 3·6 cu.ft. of oxide in the whole system per 1,000 cu.ft. of gas purified per day. Reference to fig. 3 will show also that under these conditions 1 cu.ft. of the oxide would purify about 125,000 cu.ft. of gas.

In the experiments the residual H_2S in the purified gas decreased steadily as the time of contact increased, until at 77 sec. it was only a fraction of a grain per 100 cu.ft. The time of contact suggested for practical working would obviously give an adequate degree of purification. The experiments also demonstrated that the admixture of 1·4 to 1·5% by volume of air—*i.e.*, about 0·3% of oxygen—is ample, under our conditions, for the purpose of revivification. It is important to keep the amount of oxygen as low as possible, since superfluity of this gas causes corrosion in the boxes.

The question arises whether it is advantageous to design purifier boxes on the large side as a measure of safety. Suppose a box filled with new oxide is placed first in rotation. The sulphiding and re-oxydizing actions proceed simultaneously, the latter (according to American authorities) at about one-third the rate of the former and requiring, therefore, a longer time of contact. So long as the mass is of uniform grade and remains porous the gas flows evenly through the whole cross-section of the box, and the reactions take place, as it were, layer by layer. The effects of revivification develop most quickly in the earlier layers. If there is too much material in the box the time required for the whole to be spent to the desired sulphur content is excessive, and those layers which have been soonest spent dry up and cake, thus increasing the resistance to a degree which may necessitate the box being prematurely shut off. At this stage, though parts of the oxide may have reached the desired sulphur content, there may also be layers of almost wholly untouched material in the box.

Hence it is inadvisable to use a larger quantity of oxide than strictly necessary. Where boxes have been built large to provide for a future increase in the load, it is, therefore, suggested that only sufficient oxide should be placed in them to give the time contact necessary for the actual maximum daily load.

It appeared from the experiments described above that, while the process of purification with simultaneous revivification is dependent on the time of contact, unit volume of material purifies rather more town gas when the time is increased by reducing the velocity than for equal times obtained by increasing the depth of the oxide. For gas which contains 195-210 grains of sulphuretted hydrogen per 100 cu.ft. a time-contact of the order of 300 sec., which corresponds to 3·6 cu.ft. of purifying material per 1,000 cu.ft. of gas per 24 hr., suffices for the gas to be completely freed from sulphuretted hydrogen and for a sulphur content of 60% to be attained in the spent material—provided, of course, that a good artificial purifying composition is used. Even with a concentration of 0·3% by volume of oxygen in the gas, the oxide is satisfactorily revivified. To over-dimension the boxes is not advantageous, as certain reaction layers prematurely dry up and harden, before the remainder of the material is spent.

While the quantitative results of these experiments are not directly applicable in British practice, some development of the methods described might occasionally be applied with advantage. The considerably longer times of contact which would be required for gas produced from British coals could be provided for by increasing the lengths of the reaction vessels in the apparatus. Perhaps the suggestion might be ventured that one or other of the larger British gas undertakings might very well construct apparatus on the lines described, and carry out an exhaustive series of experiments with typical oxides in common use in Great Britain. One has the impression that there is a real need for the information that would be obtained, for, though much of it doubtless already exists in scattered form or in private hands, it does not appear to be generally available anywhere.

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Electricity Bills

We gave last week a *précis* of the clauses of various Bills which have been deposited for the Parliamentary Session 1937-38 in so far as they affect gas interests.

Certain of the Electricity Bills may also be of interest to the Gas Industry inasmuch as they are concerned with amalgamation and joint working. Details of these are given below.

Aberystwyth Corporation.

The Bill provides that the minimum quarterly charge of the Aberystwyth Corporation for Electricity may be claimed by the Corporation whether or not any electricity has been consumed during the period to which the charge relates.

Blackburn Corporation.

An extremely interesting provision with regard to Central Electricity Board is contained in the Blackburn Corporation Bill, which recites that the Corporation are owners of an electricity generating station suitable to be designated as a Selected Station except that the annual capital charges on the station are unduly high by reason of the cost of labour and materials at the time of construction.

The Electricity (Supply) Act, 1926, provides (in effect) that the price to be paid by the Board to selected stations shall be based upon the cost of production at these stations. The Blackburn Bill authorized the elimination of a proportion of the capital charges of the Corporation in estimating the cost of production.

Electric Supply Corporation.

The Bill promoted by the Electric Supply Corporation is for the purpose of transferring to the Corporation the following Electricity Companies: Burgess Hill Electricity Company, Central Sussex Electricity Company, Seaford and Newhaven Electricity Company, Steyning Electricity Company, and the Electricity Undertaking of the Uckfield Gas and Electricity Company. From the date of the transfer the name of the Uckfield Company will be changed to "the Uckfield Gas Company."

Shropshire, Worcestershire, and Staffordshire Electric Power.

The main purpose of the Shropshire, Worcestershire, and Staffordshire Electric Power Bill is to consolidate the Acts and Order of that Electric Power Company. Further powers would also be conferred upon the Company, such as those of acquiring generating stations, laying connecting mains, and of making agreements with contiguous undertakers.

A Solvent Method for the Examination of Coal Tars

by
W. G. ADAM,
W. V. SHANNAN,
and
J. S. SACH

From a Paper read at a Joint Meeting of the London Section of the Road and Building Materials Group of the Society of Chemical Industry on Nov. 1, 1937. Re-printed from the November issue of the Society's Journal.

The scheme of research outlined in an introduction to this Paper included a proposal to correlate the physico-chemical characteristics of tars with their behaviour in road practice. For this practice it was essential that the resolution of the tars into groups of constituents should be effected at temperatures at which thermal decomposition would not occur. This necessitated the adoption of solvent methods, and a review was made of previous investigations into the constitution of coal, coal tars, and asphalts.

Consideration of the various methods of separation stressed the importance of using the solvents in order of their surface tensions. The advantage is thereby gained that group precipitation is obtained in order of molecular complexity. With these points in mind a tentative scheme was adopted, based on the use of pyridine, benzene, and light petroleum (b.p. 40—60°) in this order—that is to say, in order of decreasing surface tension. This involved removal of the fractions insoluble in the solvents and evaporation of the filtrates to a small bulk before pouring into a large volume of the solvent next in the series. Evaporation of the solvent from the final solution completed the operation.

The road tars prepared for this scheme of research were made by fluxing soft pitches to the required viscosity, a method used by many tar distillers. The solvent treatment was, however, applied to the soft pitches for the following reasons.

Earlier experiments at Beckton had shown that the setting properties of the road tars at ordinary temperatures were controlled mainly by the soft pitch and that the character of the fluxing oil was of secondary importance. Modifications in the fluxing oils were found to have little effect on slow-setting tars. In respect of setting properties, tars can be divided into two broad classes, high and low aromatic. A difference exists only at ordinary temperatures, as shown by the curves in figs. 1 and 2, which illustrate the results obtained by exposing films of tar in the laboratory.

These curves connect period of exposure with the percentage loss of volatile oils and the resulting mean viscosity. It will be observed that at ordinary temperatures low-aromatic tar sets more slowly than high-aromatic, whereas at higher temperatures the difference is no longer apparent. In view of this, the solvent treatment was restricted to high and low aromatic soft pitches. The use of soft pitch is justified also because it represents as nearly as possible the material remaining on the road after evaporation of the more volatile constituents of the tar.

The soft pitches were prepared by distillation in a pot still of crude high and low aromatic tars. They had ring-and-ball softening points within the range 33°-35°.

The initial experiments were carried out using the range of solvents previously specified. This yielded the so-called C_1 and C_2 as separate fractions, C_1 being insoluble in pyridine and C_2 being soluble in pyridine and insoluble in benzene. The fraction soluble in benzene and insoluble in light petroleum will, for convenience, be referred to as tar resins. The material soluble in light petroleum constitutes the non-resinous portion of the soft pitch.

Comparison of the C_1, C_2, and tar resins from the two types of pitch did not at this stage reveal any obvious differences in character, and the decision was therefore made to concentrate the examination on the non-resinous constituents. To isolate this fraction it was only necessary to use benzene followed by light petroleum.

The soft pitch was completely extracted with pure benzene in an apparatus designed to work on the Soxhlet principle. The insoluble matter ($C_1 + C_2$) was removed by filtration and washed with pure benzene until free from soluble material. The benzene solution was concentrated *in vacuo* until the volume of the solution corresponded with 5 ml. per g. of the soft pitch originally employed. This concentrated solution was slowly poured with vigorous stirring into ten times its volume of light petroleum. The precipitated tar resins were then removed by decantation and filtration and washed thoroughly with light petroleum. If this washing is well carried out the tar resins are obtained as a dry powder, whereas incomplete removal of the oily constituents will leave a tacky mass. The light petroleum was removed from the filtrate by distillation at atmospheric pressure, the last traces being removed *in vacuo* at 120°.

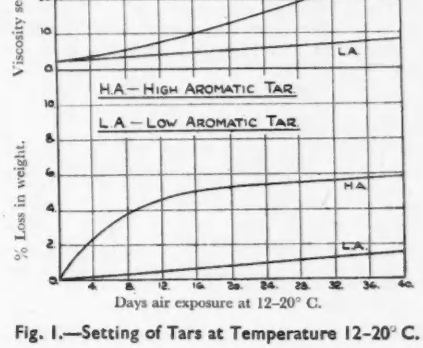


Fig. 1.—Setting of Tars at Temperature 12–20° C.

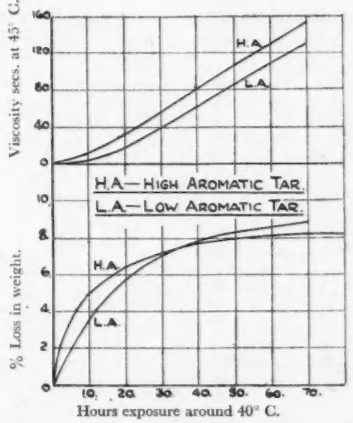


Fig. 2.—Setting of Tars at Temperature Around 40° C.

At the time of these experiments it was not found possible to effect a quantitative separation of the non-resinous constituents in a single stage, using light petroleum alone. In order to obtain the $C_1 + C_2$ and tar resins free from adhering oils the intermediate benzene stage was essential. It has since been found possible to effect the separation of the non-resinous constituents by a single-stage treatment with light petroleum in an autoclave at a temperature not exceeding

150°, under which conditions thermal decomposition does not occur.

The fraction insoluble in benzene ($C_1 + C_2$) represents the so-called free carbon of tar and is grey or grey-black in colour, according to whether it is of low or high aromatic origin. Extraction with pyridine resolves it into C_1, an amorphous and infusible black powder, and C_2, which is brownish-black in colour, is resinous, and possesses powerful binding properties when dispersed in heavy tar oil. The tar resins, in contrast to the free carbon, are light to reddish-brown in colour, according to their source. On being gradually heated they become plastic and intumesce as the temperature approaches 140°. These resins are soluble in heavy tar oils, producing viscous and adhesive fluids. Solutions of this nature are, however, of much lower viscosity than solutions of C_2 of the same concentrations (Morgan & Mitchell, Highways and Bridges, June 19, 1935).

The non-resinous or light petroleum-soluble fraction is yellowish-red and semi-solid or quite fluid in character, depending on its origin; that from high-aromatic pitch tends to deposit crystalline material. The thermal stability of this fraction is considerable and distillation may be effected at atmospheric pressure up to a temperature of 410° without apparent decomposition. Exposure of thin films of the light petroleum-soluble fractions to the atmosphere resulted in the formation of both light petroleum and benzene insoluble resins. This supports the view that oxidation results in molecules of greater complexity which require solvents of higher surface tension for dissolution. At the same time it was observed that at ordinary temperatures the low-aromatic oil film was the slower drying of the two.

The following table gives the proportions by weight of the fractions present in the typical soft pitches used for this investigation:

Fraction.	Soft Pitch from—	
	High Aromatic Tar.	Low Aromatic Tar.
Insoluble in benzene $C_1 + C_2$ ..	$C_1 = 10{\cdot}5\%$, $C_2 = 11{\cdot}5\%$ } 22%	$C_1 = 5{\cdot}5\%$, $C_2 = 8{\cdot}5\%$ } 14%
Insoluble in light petroleum, soluble in benzene .. .. .. Tar resins	20%	22%
Soluble in light petroleum .. Non-resinous	58%	64%

An important point emerges from a study of these results when it is borne in mind that the pitches are of equal consistency. It follows that the constituents of the low-aromatic pitch insoluble in light petroleum (amorphous and resinous constituents) must possess to a greater degree the property of

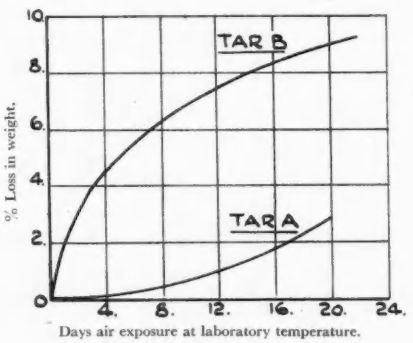


Fig. 3.—Setting of Reconstituted Tars.

conferring viscosity on the oils with which they are associated. C_1 is considered to function purely as a filler. It has been shown at Beckton that the C_2 from a low-aromatic pitch when dissolved in fluxing oil is far more effective in conferring viscosity than the C_2 from a high-aromatic pitch. The tar resins exhibit no apparent difference. This property of low-aromatic C_2 furnishes an explanation of the fact that when oiling back pitches of equal consistency to road tars, low-aromatic pitches invariably require more oil than high-aromatic. The higher proportion of oil present in low-aromatic soft pitch suggests the possibility of low-aromatic road tars being the more durable.

Two reconstituted road tars A and B were prepared by blending certain of the fractions in the correct proportions, with the addition of the appropriate amount of low-aromatic fluxing oil. In tar A only the fractions from low-aromatic soft pitch were used, and in tar B the low-aromatic non-resinous fraction was replaced by the corresponding

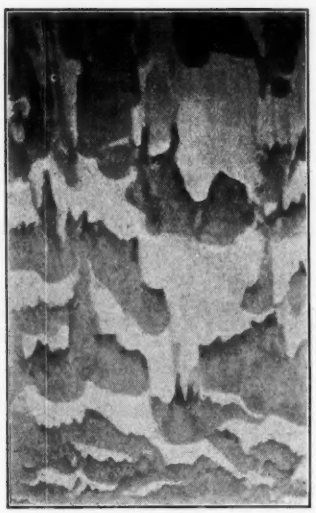


Fig. 4.

high-aromatic fraction. The setting properties of these reconstituted tars are shown graphically in figure 3, and the effect of interchanging the non-resinous constituents is clearly shown. This justified the earlier decision to concentrate the examination on the non-resinous constituents, as such an examination now appeared likely to throw some light on the question of setting.

A further indication of the influence of the non-resinous constituents on the characteristics of a road tar was obtained when films of these constituents were submitted to spinning. The high-aromatic fraction gave a uniform film, whereas the low-aromatic fraction gave the broken film characteristic of low-aromatic tars shown in figure 4. Moreover, this broken film effect disappeared on raising the spinning temperature to 32°.

Attention was now focused on the non-aromatic constituents of the non-resinous fractions. Both fractions were shaken with dimethyl sulphate, which removes the aromatic and unsaturated hydrocarbons, leaving the saturated hydrocarbons unattacked. The latter were dissolved in light petroleum and the solution was separated and washed with concentrated sulphuric acid to remove resinous and tarry matter. Evaporation of the solvent left a pale yellow material resembling vaseline. The proportions of this unsulphonatable material present were 1% and 7·9% in the high and low aromatic fractions respectively, corresponding with 0·6% and 5·1% in the soft pitches. The addition of 6% of unsulphonatable material from the low-aromatic source to the high-aromatic non-resinous fraction conferred low-aromatic characteristics, insofar as the material now gave a broken film on spinning.

The addition of unsulphonatable material from either source to a high-aromatic road tar retarded the setting (figure 5). As little as 1% had a definite effect.

The effect of a minute film of paraffin wax on the setting of a high-aromatic tar was shown by experiment. A solution of paraffin wax in light petroleum was poured on and off a surface of high-aromatic tar. The amount of wax remaining on the tar after evaporation of the light petroleum was equivalent to a film thickness of 0·0007 mm. This minute film definitely retarded setting for a day or two, after

which it took its normal course. Probably by this time such a film of wax had been absorbed by the oily medium of the tar.

That no bulk separation of any constituent occurs at the surface of low-aromatic tar under ordinary storage conditions has been proved by keeping long columns of tar undisturbed for several months.

It has been demonstrated that continual disturbance of the surface of a low-aromatic tar enables setting to proceed at a

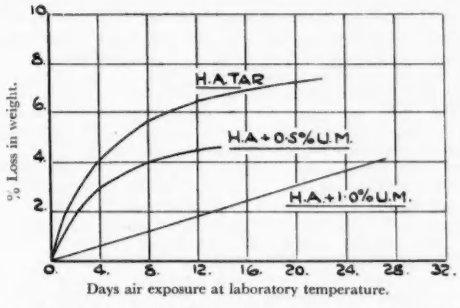


Fig. 5.—Setting of High Aromatic Tar After Addition of Unsulphonatable Material.

rate similar to that of high-aromatic tar. The experiment was effected by using an L-shaped stirrer in a shallow flat tray of tar which was free to move at random upon a smooth support. This observation suggests that the setting of a low-aromatic tar surface in cold weather may be assisted by the disturbance due to traffic.

Low-aromatic soft pitches from many sources have been subjected to this method of solvent analysis. In every case the quantity of unsulphonatable material obtained was sufficient to ensure that road tars produced from these pitches would conform to type.

The unsulphonatable portion of the non-resinous fraction is of a semi-solid and waxy nature, and is completely fluid above 32°. Its composition has not been ascertained, but indications suggest that it is a complex mixture of waxes. The presence of traces of resinous constituents renders purification difficult. A wax of good colour-stability was obtained by distillation of the crude product followed by recrystallization from acetone.

Waxes have been isolated from low-aromatic soft pitch by an alternative method. The pitch was steam-distilled at a temperature not exceeding 370°. The distillate was treated with dimethyl sulphate and concentrated sulphuric acid and non-sulphonatable material amounting to 4·3% of the soft pitch was recovered. After recrystallization from acetone an opaque white wax of d_4^{41} 0·814 was obtained. This wax, on melting and cooling, became cloudy at 41° and had a molecular weight of 344, determined by the freezing point method in benzene. This corresponds closely with the formula $C_{24}H_{50}$ of the paraffin series, but this compound should melt at 51° and have d^{81} 0·778. The general conclusion is that the isolated wax is a mixture and may contain waxes other than those of the paraffin series.

It has been found possible to lower the transition point of low-aromatic tars and improve their setting properties by (*a*) chemical methods of treatment, (*b*) blending with high-aromatic tar, (*c*) the addition of certain materials. Included under (*c*) are certain very finely-divided materials such as lamp-black or bentonite, incorporated by special methods. A very simple method in the same category is blending with asphaltic bitumen. The addition of 10% of bitumen is sufficient to lower the transition point of low-aromatic tar from 32° to below 25°.

The close control of the properties of road materials required for different purposes is essential. The incorporation of the results of these researches into works methods has made this possible in the case of road tar.

Incandescent Gas Lighting

From a Paper presented to the Illuminating Engineering Society at a meeting held in London on Dec. 14, 1937.

by
DEAN CHANDLER
(of the South Metropolitan Gas Company).

It has always been one of the advantages of low-pressure gas lighting that the light may be dimmed at will, but hitherto, with high-pressure gas lighting, some difficulty has been encountered because of the tendency of the flame to contract within and away from the mantle; but with the bag-shape mantle it is possible to reduce the pressure at the nozzle from 81 in. to 30 in. w.g. when the flame still burns in contact with the mantle fabric, giving about half the amount of light obtained at full pressure and consuming about half the quantity of gas. This valuable property makes it possible to provide, at the same installation cost, increased illumination at the hours of greatest traffic, and then, during the later hours of the night, to provide illumination, which, although reduced, is amply sufficient in these circumstances and in excess of that customary during these hours.

The shape of the mantle and the gas burner nozzle are important factors in relation to the amount of light obtained and its distribution, and the Author has often considered the possibility of some modification to the usual shape of low-pressure incandescent mantle, which would give some increase in the efficiency of the lamp.

Dr. Killing, some few years ago, investigated this point, and his work led him to the conclusion that much was possible in this regard. He found that a mantle shaped as shown in fig. 1, in conjunction with a nozzle, the lower extremity of which extended to a point near to the bottom of the mantle, gave a considerable increase in the amount of light for a given quantity of gas.

Dr. Killing's important discovery does not appear to have had the attention it deserved.

The Author has recently investigated Dr. Killing's views, and a mantle and burner made in accordance with his suggestion gave the interesting distribution shown in fig. 2. For comparison the results obtained with an ordinary burner

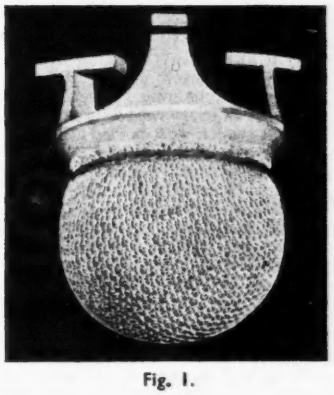


Fig. 1.

and mantle, consuming gas at the same rate and pressure, are graphed in this figure. Burners are now being designed to take advantage of this valuable improvement.

The advantage obtained by applying recuperation to the

incandescent gas burner does not appear to have been either fully investigated or exploited.

Some unpublished results of experiments made in the Physical Laboratory of the South Metropolitan Gas Company to determine the effect of preheating the secondary air supplied to a low-pressure incandescent mantle show that an appreciable increase in luminous efficiency is so obtained. The secondary air was metered and passed through a heated glass tube and thence into a specially constructed glass globe which surrounded the incandescent mantle. An increase of 20% in the luminous output is obtained when the temperature of the secondary air is raised to approximately 480° C.

Where the gas supplied to incandescent burners is standard as to its quality, the use of adjusting devices is unnecessary. The orifice or orifices through which the jet of gas issues may be "fixed" so that only a specified and predetermined volume of gas can pass to the mantle. Likewise, the air ports are "fixed" to allow only the correct volume of air to be entrained by the jet of gas to give the required character of flame on combustion.

With the latter type of inverted incandescent gas burner objection is sometimes made to the slight hiss produced by the issuing jet of gas from the ejector orifice. It is now possible to overcome this by means of a pressure damping device fixed immediately above the fixed proportioned orifice.

Modification of the nature of the light can be effected by the alteration in the rare-earth impregnation of the mantle

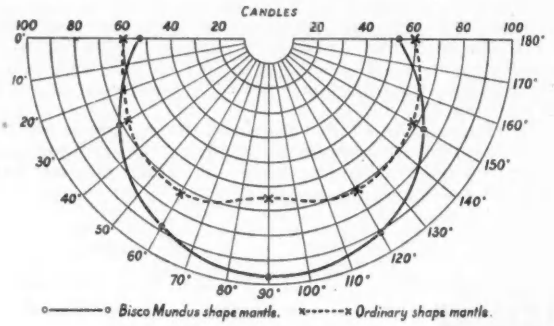


Fig. 2.

fabric. The availability of the "daylight" quality of artificial illumination so obtained, at the expense of only a small loss in illuminating efficiency, opens up a large field of application of this form of lighting in the industrial world. This lighting, cheap in production and installation, is abundant in quantity, and can, therefore, be employed in processes which have hitherto been denied its advantages by reason of prohibitive cost.

Discussion.

The PRESIDENT (Dr. S. English), thanking Mr. Chandler for his interesting Paper, said they were most grateful to him for his explanation of modern gas lighting. After hearing it they had no doubts that the Gas Industry was very much alive. He proposed a vote of thanks, which was carried with acclamation.

Mr. A. CUNNINGTON said that had he known a short time ago it was possible to utilize what he would call the "waste heat" of gas lighting in the manner described in the Paper, he might have been able to find an easier solution to a certain problem with which he had recently been faced. In connection with the utilization of the heat from gas lighting sources, it was well to note that the hours of greatest darkness as a general rule coincided with the cold season of the year. This heat had sometimes been regarded as a drawback, but that was certainly not the case when it was utilized as suggested in the Paper. The same ingenuity shown by the Gas Industry in making use of that heat was to be seen in the disperser described in the Paper. He had followed closely the remarks of the Author on the shape of mantles, and he wished to ask Mr. Chandler if in the near future there was going to be any fundamental change in mantle construction. An aspect in which he was naturally interested was the important question of maintenance, and he suggested that gas lighting would not, perhaps, be so cheap if those costs were taken into consideration. Maintenance was fully recognized by gas undertakings, and everyone, he thought, knew full well how excellently this was carried out—especially in regard to public lighting. They had definite indications of the simplification of domestic gas lighting burners in the work of the South Metropolitan Gas Company on the fixed injector principle. He wondered if that type was satisfactory where there were variations of gas pressure, and, if it were possible, how far automaticity could be made to meet those variations. He thought that the low-pressure lamp giving a high-pressure effect, which they had seen at the Conference of the Association of Public Lighting Engineers at Folkestone, was a move in the right direction because it obviated the complexities of the high-pressure system. He agreed, however, that the high-pressure system had its advantages, but there were cases where the high-pressure required was one of its drawbacks. He could not agree with Mr. Chandler's rather clever way of suggesting that all light was thermal in origin.

Mr. F. C. SMITH (Gas Light and Coke) said he would like to congratulate Mr. Chandler's Company on the work they had done for lighting. He had seen some of the care exercized in the production of their burners. Both the gas and electric industries suffered from the sale of cheap lighting fittings which did credit to neither industry. If they were to hand on to the public a well-designed article, they must produce an efficient article at a low price, and this, he thought, was achieved with the "Metro" burner. He had hoped that Mr. Chandler would have had something to say on the physics of the Bunsen burner, for those physics were every bit as interesting as the physics of any other source of illumination. They often heard of the effects on light output of varying gas pressures; they heard that from their competitors, made in all sincerity, because they realized that with an electric source the light output varied with the square of the voltage change. But with gas lighting, the output varied as the root of the pressure, which, of course, could be controlled by a pressure governor. It was possible with efficient maintenance to maintain a constant light output with gas lighting. The Gas Light and Coke Company undertook to keep within 25% of the initial value. That was an important matter, and since street lighting was strictly competitive and the Company could win under those conditions, it was not an uneconomical proposition. There had been no reference in the Paper to the ignition of gas. It was true that the cold catalyst had not been generally applied in the field of gas lighting, although it had largely been applied to gas fires. The application of cold catalytic ignition to gas lighting resulted in considerable saving, and, at any rate, the Industry did not like to rely any more than it could help on the dry cell.

Mr. W. F. THORNE (Bournemouth Gas and Water Company) asked Mr. Chandler what he considered to be the greatest permissible Ott Number variation, using the aeration test burner, without affecting the light output of the fixed injector burner.

Mr. K. F. SAWYER (Gas Light and Coke Company) asked Mr. Chandler what he thought about the explanation offered by Rubens of the proportions of thoria and ceria in the mantle fabric. He thought that Rubens gave them a very satisfactory picture of what happened on the surface of the mantle.

Mr. J. S. DOW said that the results achieved with the daylight mantle were very interesting and he had been struck with some figures given him in this respect. He thought that the Gas Industry should make this mantle more widely known. He recalled that in the early days of the "Supervia" lamp there was a deal of trouble with the breakage of mantles, and he wondered whether the mantles were now as lasting as the spherical type.

Dr. S. ENGLISH observed that in the Paper a great deal had been made of the advantages of the heating aspect of gas lighting, but he wished there were not quite so much heat from the burner, for it was a hard task to make glass that would stand up to that heat, especially in the case of high-pressure lighting. He would ask Mr. Chandler if it were possible to give more light and less heat. Regarding the daylight mantle, he asked how closely this approximated to real daylight, and if this was achieved with a very small loss of light, then the Gas Industry had something the electricians certainly had not, for true daylight cost them 75% of the light output in its correction. Did the daylight mantle maintain its colour correction throughout its life or did it gradually deteriorate? He wondered if the degree of superheating in gas lighting burners had yet reached its maximum as was the case with some gas-fired furnaces.

Mr. Chandler Replies.

Replying to the various points raised, Mr. DEAN CHANDLER told Mr. Cunnington that it was only possible for him to say that experiments were being carried out which indicated that there was a possibility of a good deal more being done to increase the efficiency of gas lighting than had been realized. He could not answer his question any more definitely than that. They had not reached finality in the matter of developing new shapes of mantles. Maintenance was an old, old question, and nobody knew as well as Mr. Cunnington that it depended on so many factors. It was impossible to express it in exact figures. His Company had found, in regard to public lighting, that if main-

tenance were carried out regularly by trained men, its cost in relation to the total cost of the lighting was extremely small. In this respect it might interest him to know that in recent months at least a dozen factories had adopted gas lighting having regard to cost of upkeep and general utility. But a maintenance figure per therm was quite impossible. Regarding the fixed injector burner, in London the variations in both gas pressure and quality were very small, and if governors were fitted, any difficulties that might arise were almost neglible. At all events, if there were to be an increase in pressure, it merely meant that there was entrained a greater proportion of air, and, therefore, the amount of gas passed developed a greater temperature with a corresponding increase in light output. Of course, there was this aspect, that a considerable rise in gas pressure would result in noise from the burner. This noise could be obviated by operating the adjuster or, if the burner were "fixed," by adjusting the tap. At the present time, there were 1½ million "fixed" burners in use, and were giving great satisfaction.

Replying to Mr. Smith, who had been disappointed that the Paper had included nothing on the subject of the physics of the Bunsen burner, he suggested that Mr. Smith was the most competent person to deal with that subject, and he hoped that the Council of the Society would invite Mr. Smith at some early date to give a Paper on that subject. He was familiar with the work that was going on at Watson House on the ignition of gas by the cold catalyst, but he was of the opinion that it was not yet out of the wood, but once it was established as a satisfactory device it would obviate the use of the dry cell, which he did not think was the best way of igniting gas. If the work at Watson House was satisfactory, then the electricians had better look to their laurels.

He was not in a position directly to answer Mr. Thorne's question regarding the Ott Number variation. In reply to Mr. Sawyer, who asked about Ruben's theory of the activation of the mantle, he rather inclined to the view of Professors Vincent B. Lewis and Smithells and Dixon. In reply to Mr. Dow, he said that it had always been the fault of the Gas Industry to "hide its light under a bushel." Wherever the daylight mantle had been used it had given satisfaction. Regarding the life of the mantle of a "Supervia" lamp, he observed that Mr. Dow had been referring to the days of its "teething" troubles. The life was now 20 to 25% longer.

Dr. English had complained of the effects of high temperature on glassware, and he suggested that that was surely a subject for research in Dr. English's own line of business. Glassware was not used in factory installations, and, therefore, a good deal of the maintenance problems raised by Mr. Cunnington vanished. It was a new one to him to hear that the glass of a gas lamp got red hot, and if the glass stood up to that without fracturing, he suggested that it must be very good glass!

Gas Undertakings' Results

Consumers' Gas Company of Toronto.

A very satisfactory position is shown by the eighty-ninth annual report of the Directors of the Consumers' Gas Company of Toronto for the year ended Sept. 30, 1937. The revenue from the sale of gas was $5,319,527.84, an increase of $92,764.89 as compared with 1936. Sales of appliances amounted to $309,142.06, an increase over the sales of the preceding year of $56,244.42, or 22%, and an increase over the sales of 1934 of 84%. An important feature is the ever-increasing use of gas by industrial undertakings. The volume of gas sold for use in industrial plants in 1937 was greater than that sold in any previous year and exceeded the volume sold in 1936 by 9%.

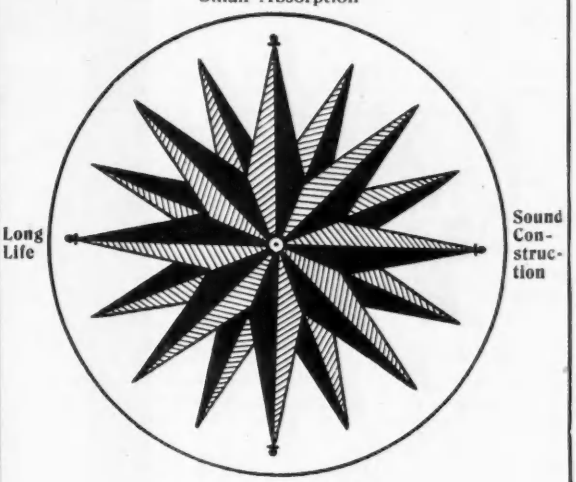
Perth (Australia).

The annual report of the Perth (Australia) Gas Department for the year ended Sept. 30, 1937, states that there has been an increase in the gas manufactured of 6·4%, from 400,654,000 in 1936 to 426,300,000 cu.ft. in 1937, and an increase in gas sold of 6·25% from 358,832,164 in 1936 to 381,247,118 cu.ft. in 1937. The thermal yield per ton of coal carbonized was 90·83 as against 87·16 during the previous year. The number of meters has increased by 1,495, from 21,804 to 23,299. Total receipts have risen from £530,288 in 1936 to £546,139 in 1937 and gross profit has also increased, from £133,922 to £124,722.

Tyldesley.

In his annual report for the year ended March 31, 1937, Mr. F. Peel, Engineer to Tyldesley Gas Department, reports that total income amounted to £12,604 and expenditure to £12,327, making a gross profit of £277. From this has to be deducted £216 for interest and sinking fund charges, and £24 revenue contributions to capital outlay, leaving a net profit of £37.

All the Cardinal Points



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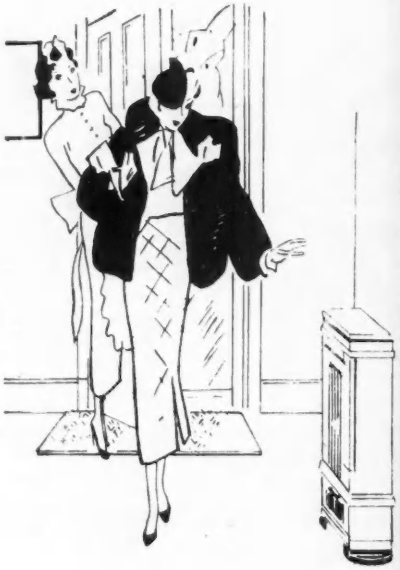

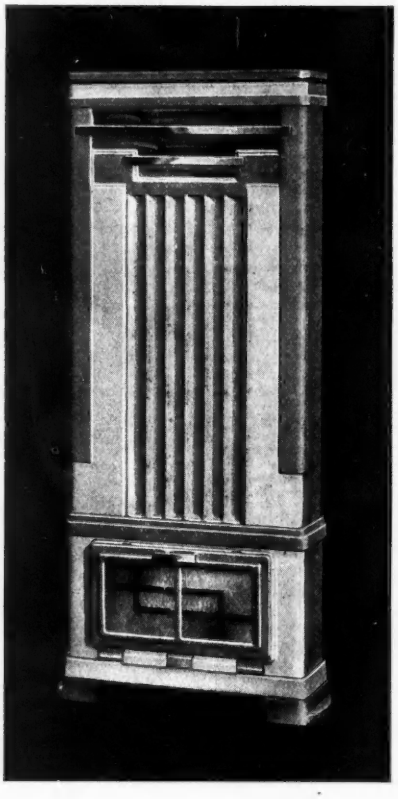

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Trade Notes

Dry Gasholders, Ltd. : New Telephone Number.

The telephone number of Dry Gasholders, Ltd., 39, Victoria Street, S.W. 1, has been changed to Victoria 3121.

F. C. Construction Co., Ltd. : Change of Address.

The new address and telephone number of F. C. Construction Company, Ltd., are City Road, Derby, and Derby 4112.

Samuel Cutler and Sons, Ltd. : Telephone Number.

The telephone number of Messrs. Samuel Cutler & Sons, Ltd., 39, Victoria Street, S.W. 1, has been changed to Abbey 3121.

Aluminium Paint.

A booklet on aluminium paint has been published by the Northern Aluminium Company, Ltd., Bush House, London, W.C. 2. It is, in effect, a survey of many of the present and potential uses of aluminium paint manufactured from paste. The general benefits of an aluminium paint are discussed and test results are quoted. The booklet is divided into about twelve main sections dealing with the use of aluminium paste paint for the protection of wood and metal, its value in painting storage tanks and pipes, for the preservation of steelwork, cement finishes, &c. A concluding chapter contains a list of recommended media for use with the new paste.

Licence for Tower Purifiers in Great Britain.

Messrs. Bamag-Meguin A.G., of Berlin, wish to inform their friends that they have appointed Messrs. W. C. Holmes & Co., Ltd., sole licensees for the manufacture and sale of their tower purifying plants in accordance with the Lenze-Thyssen patents.

The principal features in purifiers of this design are the saving in ground space and foundation work, and also the very low labour costs for handling oxide owing to the patented design of container for the oxide, removable from the tower by the means of a portal crane or gantry and crane.

The first tower purifier plant of this type was installed at the Gas and Water Works of Messrs. Thyssen at Hamborn, Germany, in 1928, and had a capacity of 10·6 million cu.ft. per diem. It was subsequently extended to a capacity of at present 52 million cu.ft. of gas per diem, and further extensions are under consideration.

The total capacity of tower purifiers built in accordance with the Lenze-Thyssen patents installed in Germany up-to-date is over 150 million cu.ft. per diem.

In 1937 Mr. C. M. Croft, M.Inst.C.E., Chief Engineer and General Manager of the Wandsworth and District Gas Company, placed with Messrs. W. C. Holmes & Co., Ltd., an order for a similar installation of tower purifiers of capacity 10·6 million cu.ft. of gas per diem, for the Wandsworth Works of the Company. The erection of this plant is nearing completion.

Pegson Vibrating Screens.

Vibrating coke screens for gas-works are among those described in an attractive booklet recently published by Pegson, Ltd., Coalville, Leicestershire, dealing with the firm's plant for such purposes as screening, sieving, and grading. The "Pegson-Telsmith" heavy duty screen is specially designed for screening coal and coke, both wet and dry. Each component of the screen is designed with an ample margin of strength, and the robust construction of the machine enables it to withstand the conditions which, with plant of this nature, are necessarily severe. The eccentric action of the vibrating unit produces a circular movement in a vertical plane which causes the aggregate to dance over the mesh. The vibration is uniform on all parts of the mesh and on every deck, and is definitely controlled; whether the screen be fully laden or running light the movement never varies in intensity. Pegson "Live-wire" screens are designed for the grading of smaller sizes than those for which the heavy duty screen is constructed. Being compact, "Live-wire" screens may be placed in confined spaces where little headroom is available, can be incorporated in existing circuits without alteration to the general plant layout, and often result in considerable economies in production costs.

So smooth is the vibrating action that at a short distance no movement is visible. When material flows on to the screen, however, this impression is instantly dissipated; the intense vibratory movement rapidly stratifies and accurately grades the material. The Pegson open deck screen is a development of the "Live-wire" screen and embodies a smaller but heavier vibrating unit. This unit is placed below the deck and is encased and thus is clear of all material; the flow of which is free and unobstructed.

Abstracts of N.P.L. Papers Published in 1936

We have received from the Director of the National Physical Laboratory a copy of a pamphlet published by H.M. Stationery Office on Jan. 10, 1938, price 1s. This pamphlet contains abstracts of the official Papers, numbering 140, published from the National Physical Laboratory in the Scientific and Technical Press during the year 1936. It is the first of a series which will be issued annually.

The purpose of the Abstracts is to provide a concise summary of the completed work of the Laboratory, supplementing the information given in the Annual Reports, and it is hoped that they will prove useful to industrial firms, research organizations, and scientific workers generally. The Laboratory will welcome opportunities of assisting British industrial firms to effect the industrial application of the results of its researches.

The Abstracts cover all the branches of work on which the Laboratory is engaged, and are grouped under the following subjects: Heat and General Physics, Sound, Optics, Photometry, Radiology, Electrical Standards and Measurements, Electrotechnics, Magnetism, Radio, Engineering, Metallurgy, Instruments, Aerodynamics, and Ship Design and Propulsion. An author index and a subject index are included.

British Standard Boiler Fittings

A British Standard Specification for Valves, Gauges, and similar fittings, forming one of a series of such specifications for land boiler installations, has just been issued by the British Standards Institution.

The materials and construction of all of the generally used types of valves, gauges, and other fittings are dealt with and certain general recommendations are included in regard to installation, although in this connection the user is directed to consult the appropriate British Standard Specification for the particular type of boiler under consideration.

Material requirements are specified for steel, cast iron, and bronze, and limits are laid down for use of the last two materials. It is specified that cast iron should not be used for:

(i.) Superheated steam at boiler pressure;
(ii.) Temperatures above 400° F.;
(iii.) Steam pressures exceeding 150 lb. per sq.in. (gauge);
(iv.) Feed valves and scum valves directly attached to boilers for pressures above 150 lb. per sq.in. (gauge);
(v.) Blow-down fittings;

and similarly that bronze should not be used for superheated steam at boiler pressure or for temperatures above 425° F.

Perhaps the most interesting section of the specification is that dealing with safety valves, which have been classified into ordinary, high, and full lift valves.

Comprehensive formulæ are included in regard to valve springs, together with a special specification for the material.

Copies of this specification (No. 759-1937) can be obtained from the British Standards Institution, 28, Victoria Street, London, S.W. 1, price 2s. 2d. post free.

Central Heating in U.S.A.

Results of the tenth annual survey of gas-fired central space heating installations in the United States and Canada, conducted by the American Gas Association's statistical department, show a substantial gain in number of gas installations connected to the lines of 268 companies between July 1, 1936, and July 1, 1937. The survey is confined entirely to the types of central heating installations reported by these 268 companies.

As mentioned in the "JOURNAL" last week, it is estimated that the total number of gas central house heating installations connected to the lines of all United States gas companies in 1937 amounted to 735,000. In addition there were approximately 1,300,000 dwellings heated by unit heaters, space heaters, floor furnaces, &c., giving a total of more than 2,000,000 homes in the United States that are heated by gas.

The total number of central house heating installations reported by the 268 manufactured and natural gas companies included in this survey was 246,782 on July 1, 1937. This was an increase of 44,741, or 22·1% as compared with July 1, 1936. Installations in manufactured and mixed gas territory showed a pronounced gain for the year, amounting to 19·7%, while natural gas installations registered an increase of 23·3%.

The manufactured and natural gas companies reported increases in all types of equipment—gas-designed and conversion jobs, boilers and furnaces. However, conversion burner installations showed a larger percentage increase than did straight gas-designed jobs.

In manufactured gas territory gas-designed installations were 50·7% of the total installations on July 1, 1937. In natural gas territory, gas-designed installations were 54·8% of the total on July 1, 1937.

As Harold the Flaxen was walking by the seashore one day he came upon three warriors setting on a shipbuilder.

On inquiring the reason he was told that the warriors had put to sea the week before in a ship made by this shipbuilder and it had capsized immediately, and they had been forced to swim ashore.

Harold asked to be shown this ship, and having seen it, he said : "You, shipbuilder, have deceived these warriors by letting them go to sea in a poorly built ship. But you three who capsized were much to blame. You had not inquired into this man's Honour nor his Reputation. Besides this, you did not assure yourselves of his Skill, his Reliability, nor his Knowledge of his Craft."

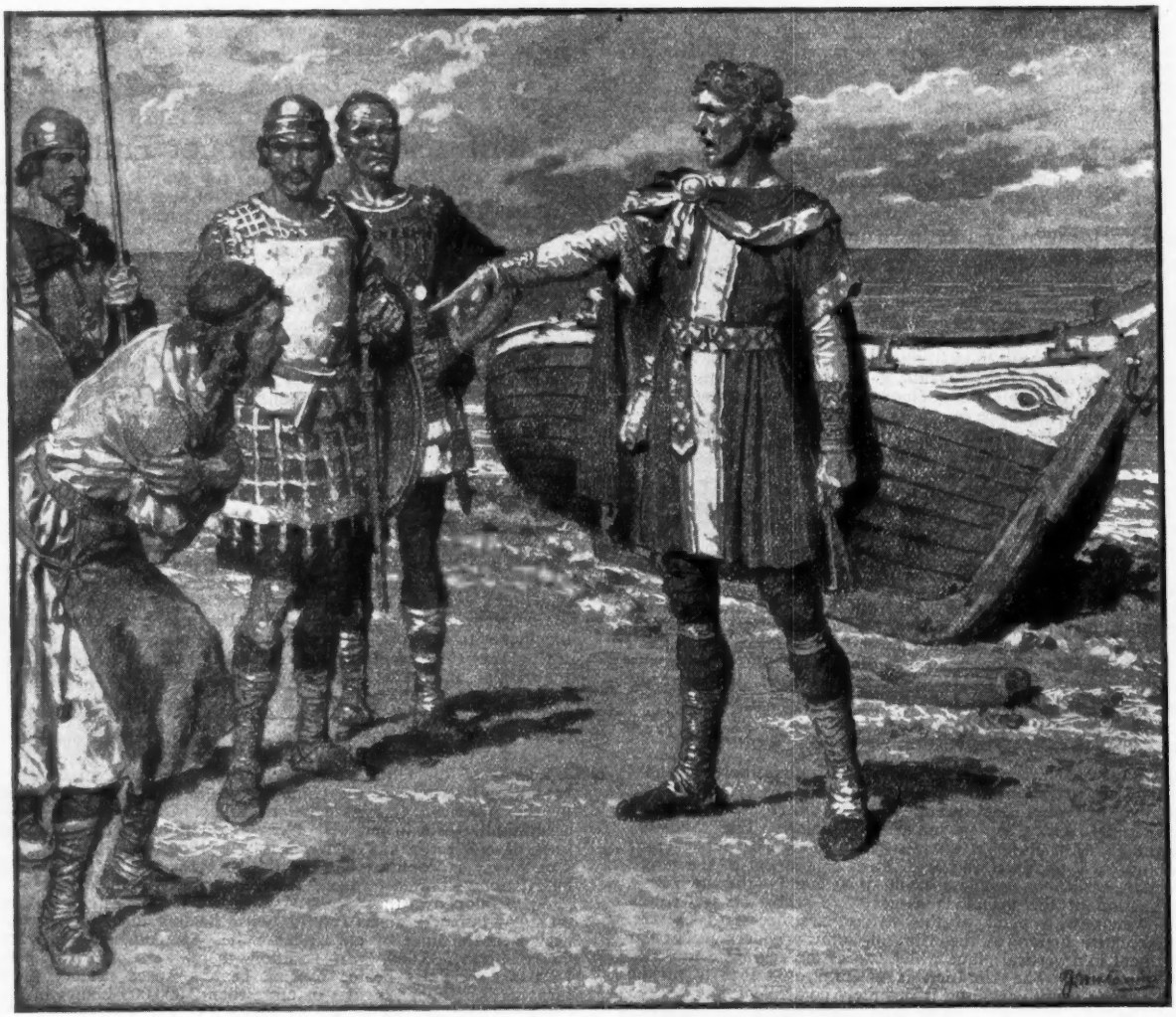


Illustration by Fortunino Matania, R.I.

As modern as to-morrow, but with the knowledge and experience of 144 years, Newton Chambers & Co., Ltd., specialise in the manufacture of Blast Furnace Plant, Gas Works Plant, Steel Works Plant, General Chemical Plant, Benzole Plant, By-Product Plant, Cast Iron Tanks, Steel Tanks, Coke Oven Machinery, Pig Iron, Excavators, General Castings for the various trades and all forms of Light Castings.

NEWTON CHAMBERS & CO., LIMITED

THORNCLIFFE IRONWORKS NR. SHEFFIELD

Markets and Manufactures

Current Sales of Gas Products

The London Market

LONDON, *Jan.* 17.

Tar Products in the London market remain unchanged at the following levels:
Pitch, 38s. per ton f.o.b.
Creosote, 5⅞d. to 6d.
Refined tar, 3¼d.
Pure toluole, about 2s. 4d.
Pure benzole, 1s. 9d.
95/160 solvent naphtha, 1s. 7d. to 1s. 8d.
90/160 pyridine, about 12s.
All per gallon naked at makers' works.

The Provinces

Jan. 17.

The average prices of gas-works products during the week were: Gas-works tar, 24s. 3d. to 29s. 3d. Pitch—East Coast, 38s. to 39s. f.o.b. West Coast—Manchester, Liverpool, Clyde, 38s. to 39s.* Toluole, naked, North, 1s. 8d. to 1s. 9d. Coal tar, crude naphtha, in bulk, North, 8d. to 8½d. Solvent naphtha, naked, North, 1s. 5½d. to 1s. 6d. Heavy naphtha, North, 1s. 3d. to 1s. 3½d. Creosote, *ex* works, in bulk, North, liquid and salty, 5d. to 5½d.; low gravity, 4⅞d. to 4½d. Heavy oils, in bulk, North, 5d. to 5¼d. Carbolic acid 60's, 3s. 6d. to 3s. 9d. Naphthalene, £14 to £17. Salts, 80s. to 85s., bags included. Anthracene, "A" quality, 4½d. to 4¾d. per minimum 40% purely nominal; "B" quality unsalable.

* All prices for pitch are now quoted on the basis of f.o.b. In order to arrive at the f.a.s. value at any port it will be necessary to deduct the loading costs and the tolls whatever they may be.

Scotland

GLASGOW, *Jan.* 15.

If anything, there is a little more actual business being placed, although values have not yet responded.

Crude gas-works tar.—Actual value is 37s. to 38s. per ton *ex* works in bulk.

Pitch remains dull at 30s. to 32s. 6d. per ton f.o.b. Glasgow for export, and 30s. per ton *ex* works in bulk for home trade.

Refined tar.—Prices for home consumption have now been fixed at a higher level and to-day's prices are as follows: For export 3d. to 3½d. per gallon and for home trade 3½d. to 4d. per gallon, both *ex* works in buyers' packages.

Creosote oil.—There is a fair throughput and prices remain steady as under: Specification oil, 5d. to 5¼d. per gallon; low gravity, 6d. to 6½d. per gallon; neutral oil, 5d. to 5½d. per gallon; all *ex* works in bulk.

Cresylic acid.—There is a lack of business of any consequence, although small orders are being fixed at the following prices: Pale, 97/99%, 3s. to 3s. 3d. per gallon; dark, 97/99%, 2s. 9d. to 3s. per gallon; and pale, 99/100%, 3s. 6d. to 4s. per gallon; all *ex* works in buyers' packages.

Crude naphtha.—Supplies are not too plentiful and value remains steady at 6d. to 6½d. per gallon *ex* works in bulk, according to quality and district.

Solvent naphtha.—90/160 grade is changing hands at 1s. 5½d. to 1s. 6½d. per gallon, and 90/190 heavy naphtha at 1s. to 1s. 1d. per gallon.

Motor benzole is now valued at 1s. 4½d. per gallon.

Pyridine.—To-day's values are 12s. to 12s. 6d. per gallon for 90/160 grade, and 13s. to 14s. per gallon for 90/140 grade.

Benzole Prices

These are considered to be the market prices for benzole at the present time:

	s.	d.		s.	d.	
Crude benzole..	0	9½	to	0	10	per gall. at works
Motor " ..	1	3	"	1	3½	" " "
90% " ..	1	4	"	1	4½	" " "
Pure " ..	1	8	"	1	8½	" " "

Contracts Advertised To-Day

Coal.
Milford Haven Gas Department. [p. 206.]

Mantles.
Stockport Gas Department. [p. 206.]

Meter Skins.
Stockport Gas Department. [p. 206.]

Meters.
Stockport Gas Department. [p. 206.]

Oils.
Stockport Gas Department. [p. 206.]

Oxide of Iron.
Stockport Gas Department. [p. 206.]

Pipes, Specials, &c.
Stockport Gas Department. [p. 206.]

Retorts.
Burnley Gas Department. [p. 206.]

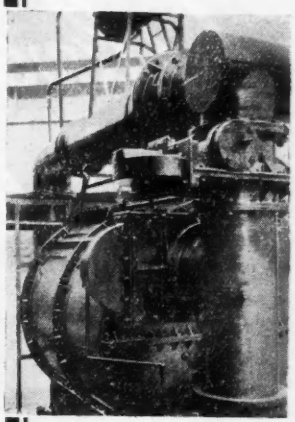
Stores.
Stockport Gas Department. [p. 206.]

British Vacuum Cleaner & Engineering Co., Ltd.

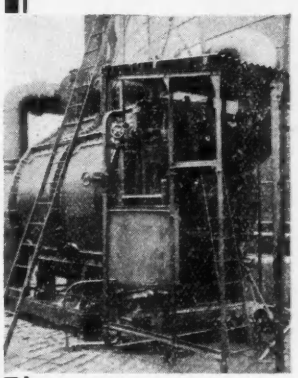
At a separate meeting of the holders of redeemable Preference shares in the British Vacuum Cleaner and Engineering Company, Ltd., followed by an extraordinary general meeting, held on Jan. 17 at the offices of the Company, Parson's Green Lane, London, S.W., resolutions were submitted increasing the borrowing powers of the Directors to a sum not exceeding twice the nominal amount of the share capital of the Company for the time being issued, and increasing the capital of the Company to £550,000 by the creation of 1,200,000 new Ordinary shares of 5s. each to rank *pari passu* with the 400,000 Ordinary shares of the existing capital.

Mr. H. C. Booth, F.C.G.I., M.Inst.C.E., Chairman and Joint Managing Director, who presided, said that the continuing expansion of the business rendered it necessary for the Company to obtain further financial facilities, which their bankers were willing to provide on terms advantageous to the Company. Their present limitation of borrowing powers handicapped them, and the Directors considered that it was in the best interests of both classes of shareholders that the limitation should be altered in the manner recommended, and they had no hesitation in asking them to approve the resolutions. There was no intention of exercising their borrowing powers to the full, but it was thought very desirable to obtain ample borrowing powers, since, if the Company's business continued to increase, as it was hoped, additional finance would from time to time be required. No immediate issue of any of the proposed new Ordinary shares was under consideration. Both resolutions were carried unanimously.

When a Joint leaks—



Permac Joints in a Gas Works.



Permac Joints in a Gas Works.

Consider the loss in output while the plant is shut down and the joint is being re-made.

"Permac" the original Metal-to-Metal Jointing makes leak-proof joints that last till you want to break them down. Stands up to all temperatures and pressures. Equally successful on steam, gas, water, oil joints.

Send for particulars.

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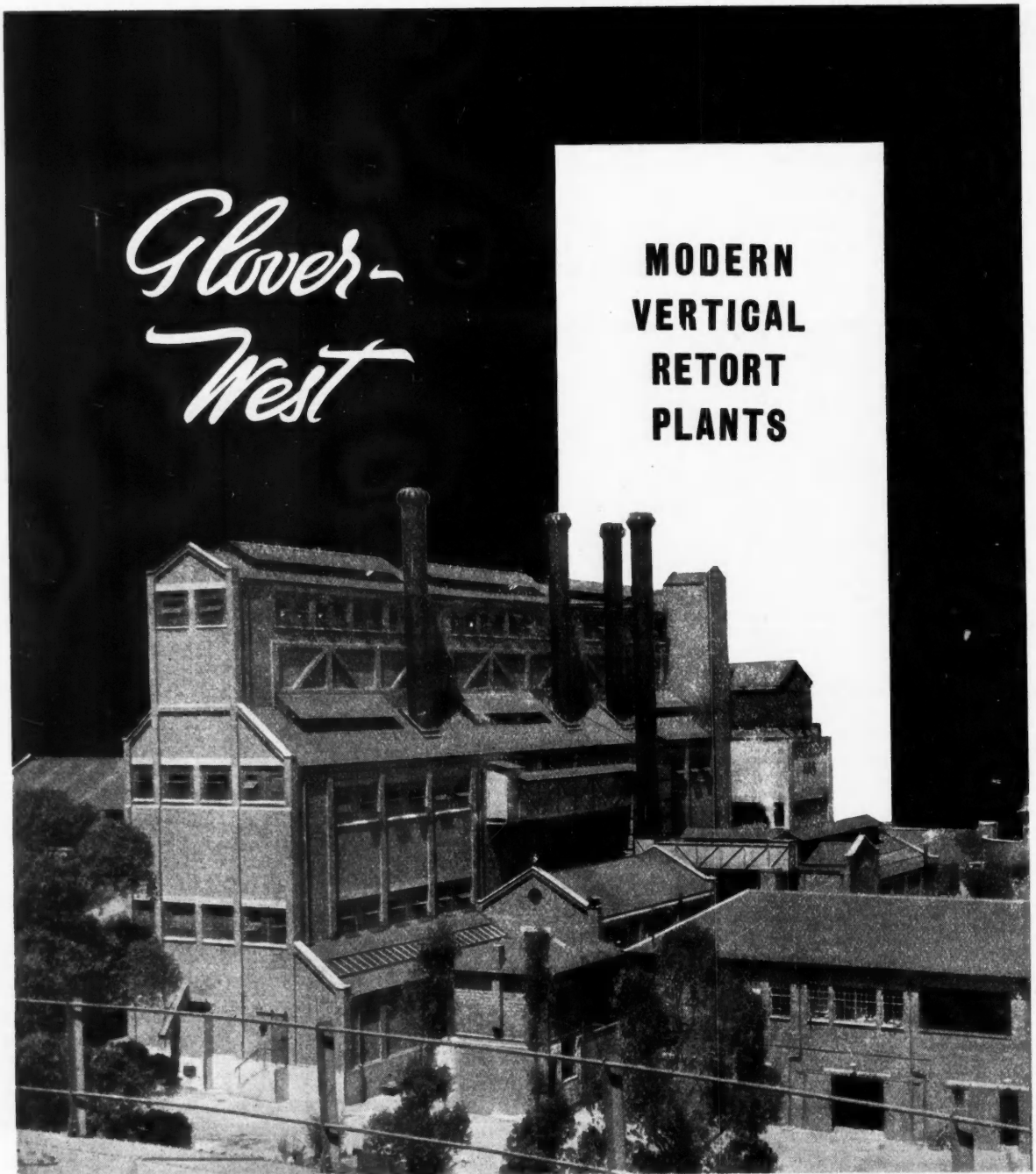
Sole manufacturers:—

THOMAS & BISHOP LTD.
37, Tabernacle St.
LONDON, E.C.2
Telephone: Clerkenwell 3351 (2 lines)



JOHANNESBURG S. A.

Since the complete new Cottesloe Gas Works was built for the Johannesburg Council by the West organisation in 1928, the original 18-retort battery of Glover-West verticals has been trebled. The third unit recently put into service is foremost in the picture. It brings the total retorts to 54 and the total production capacity of this typically modern works to 4½ million cubic feet.

● Carbonizing plants of West design and construction represent to-day's methods of gas manufacture all over the world. The 414 plants built or in progress are distributed over 24 countries.

WEST'S GAS IMPROVEMENT CO. LTD. • MILES PLATTING • MANCHESTER 10

GAS STOCKS AND SHARES

Once again Stock Exchange affairs have been influenced by political and financial upheavals abroad. The fall of the French Government with its attendant flight from the franc came suddenly, and although an endeavour was made to save the financial side the resources of the Exchange Fund soon became exhausted and control vanished, with the result that by Saturday business in francs in Paris was suspended.

Quiet conditions prevailed in most sections of the Stock Exchange, though the purchase of British securities by French nationals gave a fillip to the gilt-edged section and the Funds closed fractionally higher. Home rails were depressed throughout the greater part of the week, but became steadier on Friday, and a few recoveries were noted. Industrials generally moved within narrow limits with aircraft, coal, and steel shares making the best showing. A feature was the active buying of West African gold shares, and several prices closed substantially higher. Rubbers were inclined to harden on the increased price of the commodity.

Gas stocks and shares were by no means neglected, though prices with few exceptions remained unaltered. In the Official List, Alliance and Dublin rose 2 points to 162½, South Metropolitan ordinary closed fractionally higher, and the Primitiva two debenture stocks hardened. On the other hand, Gas Light units reacted 3d. to 24s. 9d. and Imperial Continental fell 2 points to 135½. On the provincial Exchanges Bristol and Sunderland ordinaries were marked up, and in the Supplementary List the nominal quotation of Hampton Court consolidated dropped 5½ points to 150-160, business being recorded at the lower price.

It will be noted that we have been able to extend the number of our quotations in Official List, and now include every gas stock and share officially quoted on the London Stock Exchange with the exception of the stocks of provincial undertakings, some of which are quoted in London but are here shown under their home Exchanges.

Among the parcels of ordinary stocks and shares on offer at the time of writing appear the following:

Amount.	——	Last Annual Dividend.	Price.	Gross Yield.
£		%		£ s. d.
5,000	Associated Gas and Water	5	20/6 free	4 17 6
190	Bombay £1	8	28/–	5 14 3
1,000	British	7¼	144	5 4 3
5,000	Commercial	5	83	6 0 6
10,000	Gas Light units	£5 12s.	25/3	4 8 9
2,000	Imperial Continental	10	138	7 5 0
1,000	Plymouth and Stonehouse	8	158 xd.	5 1 0
1,000	South Metropolitan	5½	104½	5 5 3
5,000	South Western Gas and Water ..	5	19/6	5 2 6
5,000	United Kingdom Corporation ..	5	20/3	4 18 9

Official Quotations on the London Stock Exchange

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Jan. 14.	Rise or Fall on Week.
1,767,439	Sept. 6	8	8	Alliance & Dublin Ord. ...	160—165	+2
374,000	Dec. 13	4	4	Do. 4 p.c. Deb. ...	95—100	...
558,890	Aug. 9	7	7	Barnet Ord. 7 p.c.	158—163	...
300,000	Oct. 49	1/9⅔	1/4⅓	Bombay, Ltd.	26/—28/–	...
179,915	Aug.	9⅛	9⅛	Bournemouth sliding scale ...	200—205	...
590,407	,,	7	7	Do. 7 p.c. max. ...	158—163	...
493,960	,,	6	6	Do. 6 p.c. Pref. ...	133—138	...
50,000	Dec. 13	3	3	Do. 3 p.c. Deb. ...	78—83	...
262,025	,,	4	4	Do. 4 p.c. Deb. ...	98—103	...
335,000	,,	5	5	Do. 5 p.c. Deb. ...	115—120	...
357,900	Aug. 9	7⅛	7⅛	Brighton, &c., 6 p.c. Con. ...	150—155	...
649,955	,,	6⅛	6⅛	Do. 5 p.c. Con. ...	133—138	...
205,500	,,	6	6	Do. 6 p.c. 'B' Pref.	127—133	...
855,000	Sept. 20	8	7	British Ord.	139—144	...
100,000	Dec. 13	7	7	Do. 7 p.c. Pref.	140—145	...
350,000	,,	5⅛	5⅛	Do. 5⅛ p.c. 'B' Cum. Pref.	110—115	...
120,000	,,	4	4	Do. 4 p.c. Red. Deb. ...	95—100	...
450,000	,,	5	5	Do. 5 p.c. Red. Deb. ...	102—107	...
450,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...
100,000	22 May'33	6	4	Cape Town, Ltd.	1½—2½	...
100,000	6 Nov.'33	4½	4½	Do. 4½ p.c. Pref. ...	1½—3½	...
150,000	Dec. 13	4½	4½	Do. 4½ p.c. Deb. ...	70—75	...
626,860	July 19	6	6	Cardiff Con. Ord.	125—130	...
237,860	Dec. 13	5	5	Do. 5 p.c. Red. Deb.	106—111	...
98,936	Oct. 4	2/–	2/–	Colombo Ord....	1⅝—1⅞	...
24,510	,,	1/4½	1/4½	Do. 7 p.c. Pref.	23/6—25/6	...
739,453	Oct. 4	–/11·48	–/11·48	Colonial Gas Assn. Ltd. Ord.	17/—19/–	...
296,144	,,	1/3·30	1/3·30	Do. 8 p.c. Pref.	22/—24/–	...
1,775,005	Aug. 9	5	5	Commercial Ord.	80—85	...
620,000	Nov. 29	3	3	Do. 3 p.c. Deb. ...	73—78	...
286,344	Aug. 23	5	5	Do. 5 p.c. Deb. ...	113—118	...
807,560	Aug. 9	7	7	Croydon sliding scale... ...	140—145	...
644,590	,,	5	5	Do max. div.	110—113	...
620,385	Dec. 13	5	5	Do. 5 p.c. Deb.	112—117	...
239,000	Aug. 9	5	5	East Hull Ord. 5 p.c.... ...	98—103	...
185,355	Aug. 9	6	6	East Surrey Ord. 5 p.c. ...	120—125	...
176,211	Dec. 13	5	5	Do. 5 p.c. Deb. ...	112—117	...
250,000	Nov. 15	7	4	Gas Consolidation Ord. ...	19/6—21/6	...
250,000	,,	4	4	Do. 4 p.c. Red. Cum. Pref.	18/6—20/6	...
19,255,284	Aug. 9	5⅛	5⅛	Gas Light & Coke 4 p.c. Ord.	24/3—25/3*a*	–·/3
2,600,000	,,	3½	3½	Do. 3½ p.c. max. ...	83—86	...
4,477,106	,,	4	4	Do. 4 p.c. Con. Pref.	100—103	...
2,993,000	July 5	...	3⅜	Do. 3⅜ p.c. Red. Pref.	102—104	+½
8,602,497	Nov. 29	3	3	Do. 3 p.c. Con. Deb.	78—81	...
3,642,770	,,	5	5	Do. 5 p.c. Red. Deb.	112—115	...
3,500,000	,,	4½	4½	Do. 4½ p.c. Red. Deb.	110—113	...
700,000	Sept. 6	3½	3½	Do. 3½ p.c. Red. Deb.	98—101	...
270,466	Aug. 23	6	6	Harrogate New Cons. ...	115—120	...
157,500	April 5	1/2⅝	1/2⅝	Hong Kong and China Ord	1—1½	...
213,200	Aug. 9	6	6	Hornsey Con. 3½ p.c. ...	118—123	...
5,600,000	Nov. 1	12	8	Imperial Continental Cap. ...	133—138	–2
223,130	July 19	3½	3½	Do. 3½ p.c. Red. Deb. ...	89—94	...
285,242	Aug. 9	8⅛	8⅛	Lea Bridge 5 p.c. Ord. ...	170—175	...
11,751	Aug. 23	10	8	Maidstone 5 p.c. Cap.... ...	180—190	...
63,480	Dec. 13	3	3	Do. 3 p.c. Deb. ...	70—75	...
75,000	Nov. 29	†10	†10	Malta & Mediterranean Metropolitan (of Melbourne)	145—155	...
392,000	Oct. 1	5½	5½	5½ p.c. Red. Deb.	100—103	...
231,978	Aug. 23	5	5	M.S. Utility 'C' Cons. ...	101—106	...
968,657	,,	4	4	Do. 4 p.c. Cons. Pref.	96—101	...
360,075	Dec. 13	4	4	M.S. Utility 4 p.c. Deb. ...	97—102	...
148,955	,,	5	5	Do. 5 p.c. Deb. ...	112—117	...
675,000	Nov. 15	†9	†6	Montevideo, Ltd.	85—90	...
250,000	Aug. 9	7½	7½	North Middlesex 6 p.c. Con.	147—152	...
396,160	Aug. 9	5	5	Northampton 5 p.c. max. ...	110—115	...
300,000	Oct. 18	†7	†9	Oriental, Ltd.	153—158	...
468,537	Dec. 13	8	8	Plymouth & Stonehouse 5 p.c.	154—159	...
621,667	Aug. 9	8⅛	8⅛	Portsmouth & Gosport Cons.	164—169	...
241,446	,,	5	5	Do. 5 p.c. max. ...	104—109	...
73,350	,,	5	5	Do. 5 p.c. Pref. ...	110—115	...
247,966	Dec. 13	4	4	Primitiva 4 p.c. Cons. Deb. ...	98—103	+3
625,959	July 5	4	4	Do. 4 p.c. Red. Deb. ...	95—100	+2
15,000	Sept. 6	6	6	San Paulo 6 p.c. Cum. Pref. ...	9—9½	...
441,275	Sept. 20	1/1½	1/1½	Severn Val. Gas Cor. Ld. Ord.	21/6—23/6	...
460,810	,,	–/10⅛	–/10⅛	,, ,, 4½ p.c. Cum. Pref.	19/6—21/6	...
133,201	Aug. 23	5	8⅛	Shrewsbury 5 p.c. Ord. ...	130—135	...
9,000	June 7	4	4	South African Ord.	3⅜—4⅜	...
1,371,752	Sept. 6	1/2⅞	1/2⅞	South East'n Gas Cn. Ld. Ord.	23/—25/–	...
871,636	,,	–/10⅛	–/10⅛	Do. 4½ p.c. Red. Cum. Pref.	20/—22/–	...
498,818	,,	4	4	Do. 4 p.c. Cum. Pref. ...	18/—20/–	...
450,000	Aug. 9	4	4	Do. 4 p.c. Deb.	99—102	...
150,000	,,	3½	3½	Do. 3½ p.c. Red. Deb. ...	96—99	...
6,709,895	Aug. 9	6	5	South Met. Ord.	102½—104½	+½
1,135,812	,,	6	6	Do. 6 p.c. Irred. Pf. ...	131—136	...
850,000	,,	4	4	Do. 4 p.c. Irred. Pf. ...	98—101	...
1,895,445	Dec. 13	3	3	Do. 3 p.c. Deb. ...	74—79	...
1,000,000	July 5	5	5	Do. 5 p.c. Red. Deb....	110—113	...
1,543,795	Aug. 9	6	6	South Suburban Ord. 5 p.c. ...	120—125	...
512,825	,,	5	5	Do. 5 p.c. Pref....	110—115	...
500,000	,,	4	4	Do. 4 p.c. Pref....	95—100	...
250,000	,,	...	§18/9	Do. 3⅜ p.c. Red. Pref.	98—101	...
888,587	Dec. 13	5	5	Do. 5 p.c. Deb....	113—118	...
250,000	,,	4	4	Do. 4 p.c. Deb....	97—100	...
200,000	Sept. 20	...	3½	Do. 3½ p.c. Red. Deb.	94—99	...
427,859	Nov. 1	1/2⅞	9⅞	S. Western Gas & Water Ord.	18/6—20/6	...
160,523	,,	–/10⅛	–/10⅛	Do. 4½ p.c. Red. Cum. Pf.	19/6—21/6	...
110,000	Dec. 13	4	4	Do. 4 p.c. Red. Deb. ...	97—102	...
750,541	Aug. 9	5⅛	5	Southampton Ord. 5 p.c. ...	111—116	...
148,836	Dec. 13	4	4	Do. 4 p.c. Deb.	96—101	...
350,000	Aug. 23	5⅛	5⅛	Swansea 5½ p.c. Red. Pref. ...	110—115	...
94,000	Jan. 3	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100*	...
1,076,490	Aug. 9	6⅝	6⅝	Tottenham and District Ord.	131—136	...
409,835	,,	5⅛	5⅛	Do. 5½ p.c. Pref....	121—126	...
62,235	,,	5	5	Do. 5 p.c. Pref....	109—114	...
371,850	Dec. 13	4	4	Do. 4 p.c. Deb....	97—102	...
85,701	July 19	‡6	6	Tuscan 6 p.c. Red. Deb. ...	96—101	...
888,629	Oct. 4	6	4	U. Kingdom Gas Cor. Ord....	19/—21/–	...
937,743	Nov. 15	4½	4½	Do. 4½ p.c. 1st Cum. Pref.	20/—22/–	...
500,000	,,	...	–/1·15	Do. 4 p.c. 1st Red. Cum. Pf.	19/—21/–	...
745,263	Dec. 13	4½	4½	Do. 4½ p.c. 2nd Non-Cum.Pf.	16/6—18/6	...
1,000,000	Sept. 20	3½	3½	Do. 3½ p.c. Red. Deb. ...	96—99	...
373,939	Aug. 9	7	7	Uxbridge, &c., 5 p.c.	138—143	...
133,010	,,	5	5	Do. 5 p.c. Pref. ...	109—114	...
1,371,138	Aug. 9	7	7	Wandsworth Consolidated ...	140—145	...
2,525,768	,,	4	4	Do. 4 p.c. Pref. ...	99—102	...
1,343,964	Dec. 13	5	5	Do. 5 p.c. Deb. ...	113—118	...
383,745	,,	4	4	Do. 4 p.c. Deb. ...	97—102	...
558,342	Aug. 9	7	7	Watford and St. Albans Ord.	140—145	...
200,000	,,	5	5	Do. 5 p.c. Pref. ...	109—114	...
200,000	,,	5⅛	5⅛	Do. 5⅛ p.c. Pref. ...	121—12⅝	...
200,000	Nov. 29	4	4	Do. 4 p.c. Red. Deb.	95—100	...
100,000	,,	3½	3½	Do. 3½ p.c. Red. Deb.	94—99	...

a.—The quotation is per £1 of stock. * Ex. div. † Paid free of income-tax ‡ For year. § Actual.

Supplementary List and Provincial Exchanges overleaf.

STOCK AND SHARE LIST—Cont.

Supplementary List, not Officially Quoted, London

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations Jan. 14.	Rise or Fall on Week.
202,152	Sept. 6	25/-b	5	Ascot Ord.	100—105	...
128,182	Dec. 13	5	5	Do. 5 p.c. Pref.	108—113	...
573,156	Nov. 15	5	5	Assd. Gas and Water Ord. ...	19/—21/-	...
167,506	,,	...	-/4c	Do. 4 p.c. Red. Cum. Pref.	19/—20/-	...
253,118	,,	...	4	Do. 4 p.c. Irred. Pref. ...	18/—20/-	...
500,000	,,	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	19/—21/-	...
500,000	Sept. 6	3½	3½	Do. 3½ p.c. Red. Deb. ...	95—100	...
31,035	Aug. 23	...	-/4½	Associated Utilities 4 p.c. Pref.	16/6—18/6	...
100,000	Dec. 13	...	3½	Do. 3½ p.c. Red. Deb....	95—100	...
17,000	Aug. 23	8	8	Bognor Orig. Ord. 'A' ...	160—170	...
62,210	,,	8	8	Do. New Addl. 'A' ...	160—170	...
87,160	,,	7	7	Do. New 7 p.c. max. ...	141—146	...
37,440	Aug. 9	10	10	Cam. Univ. & Town10 p.c. max.	193—203	...
125,970	,,	7	7	Do. 7 p.c. max.	135—140	...
39,025	,,	5	5	Do. 5 p.c. max.	98—103	...
65,000	Aug. 9	8½	7½	Eastbourne 'A' 5 p.c. ...	158—163	...
198,000	,,	7	6	Do. 'B' 3½ p.c.	128—133	...
112,312	,,	5	5	Do. 5 p.c. Pref.	108—113	...
130,000	Dec. 13	5	5	Do. 5 p.c. Deb.	113—118	...
24,000	Aug. 23	8½	8½	Great Yarmouth 8½ p.c. max.	44—49	...
59,400	,,	7½	7½	Do. 7½ p.c. max.	34—39	...
51,160	Dec. 13	5½	5½	Do. 5½ p.c. Deb.	120—125	...
152,600	Sept. 6	9	8	Guildford Cons.	170—175	...
54,055	,,	5	5	Do. 5 p.c. Pref.	110—115	...
68,250	Dec. 13	5	5	Do. 5 p.c. Deb.	112—117	...
156,600	Aug. 23	7½	7½	Hampton Court Cons. ...	150—160	-5½
73,620	Sept. 6	8½	8½	Luton Cons. 'A'	163—168	...
107,960	Sept. 20	5½	4	Mid Kent Ord.	8½—9½	...
230,940	Aug. 9	10	10	Oxford & District Ord. ...	205—210	...
47,112	,,	5	5	Do. 5 p.c. Pref.	108—113	...
50,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	110—115	...
126,193	Nov. 15	7½	7½	Peterborough Ord.	158—163	...
64,990	Sept. 6	7½	6½	Redditch Ord....	125—135	...
166,850	Aug. 9	8	8	Romford Ord....	155—160	...
60,000	,,	4	4	Do. 4 p.c. Pref.	97—100	...
44,000	Sept. 20	5	5	Do. 5 p.c. Deb.	113—118	...
25,570	Aug. 9	5½	5½	Rugby 5½ p.c. Pref.	125—130	...
25,000	,,	6	6	Do. 6 p.c. Red. Pref. ...	106—111	...
42,750	Dec. 13	5½	5½	Do. 5½ p.c. Deb.	120—125	...
10,950	Aug. 23	8	8	Ryde Ord.	158—163	...
270,086	Sept. 6	7	7	Slough Ord.	133—138	...
21,000	Dec. 13	5	5	Do. 5 p.c. Deb.	110—115	...
28,872	Nov. 1	5½	5½	S. Midland Gas Cpn. Ltd. Ord.	19/—21/-	...
28,866	Sept. 6	4½	4½	Do. 4½ p.c. Red. Cum. Pref.	18/6—20/6	...
137,730	Aug. 9	7	7	Southgate & Dist. 7 p.c. max.	140—145	...
62,500	,,	5	5	Do. 5 p.c. Pref.	110—115	...
117,228	Aug. 23	5	5	Swindon Cons.	106—111	...
60,425	Dec. 13	5	5	Do. 5 p.c. Deb.	110—115	...
64,380	Dec. 13	5	5	Torquay and Paignton 5 p.c. Pf.	108—113	...
33,858	Nov. 15	...	-/2·70c	United Kingdom Gas Corpn. 4½ p.c. 1st Cum. Pref. ...	20/—22/-	...
130,000	Aug. 9	8	5	Wakefield Ord.	120—125	...
81,650	,,	5	5	Do. 5 p.c. max.	103—108	...
82,000	Aug. 9	6	6	Weymouth Ord.	103—108	...
98,384	Aug. 9	6	6	Wolverhampton 6 p.c. Pref....	120—125	...
160,000	Dec. 13	5½	5½	Do. 5½ p.c. Rd. Db.	107—112	...
90,000	Dec. 13	5	5	York 5 p.c. Red. Deb.... ...	104—109	...
133,640	July 19	6½	6½	Yorktown (Cam.) 5 p.c. Cons.	128—133	...
120,000	,,	5	5	Do. 5 p.c. Pref.	108—113	...
35,000	Dec. 13	5½	5½	Do. 5½ p.c. Deb.	121—126	...

BRISTOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations, Jan. 14.	Rise or Fall on Week.
347,756	July 19	6	5	Bath Cons.	120—122	...
1,667,250	July 19	5	5	Bristol, 5 p.c. max.	117—118	+½
120,420	Dec. 13	4	4	Do. 1st 4 p.c. Deb. ...	100—102	...
217,870	,,	4	4	Do. 2nd 4 p.c. Deb. ...	100—102	...
328,790	,,	5	5	Do. 5 p.c. Deb.	118—121	...
274,000	July 19	5	5	Newport (Mon.) 5 p.c. max....	100—102	...
13,200	Sept. 6	8	7	Pontyp'l Gas & W. 10 p.c. 'A'	13—14	...
13,600	,,	6	5	Do. 7 p.c. 'B'	11½—12½	...
40,000	,,	6	5	Do. 7 p.c. 'C'	11½—12½	...
140,778	Aug. 9	5	5	Weston-super-Mare Cons. ...	110—112	...
64,338	Jan. 3	4	4	Do. 4 p.c. Deb.	94½—96½*	...
33,340	,,	7½	7½	Do. 7½ p.c. Deb.	154—157*	...

LIVERPOOL EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations, Jan. 14.	Rise or Fall on Week.
157,150	Aug. 9	6½	5	Chester 5 p.c. Ord.	106—110	...
92,500	Dec. 13	4	4	Do. 4 p.c. Pref.	96—100	...
36,430	,,	3½	3½	Do. 3½ p.c. Deb.	88—91	...
41,890	,,	4	4	Do. 4 p.c. Red. Deb. ...	97—101	...
2,167,410	Aug. 23	6	6	Liverpool 5 p.c. Ord.... ...	125½—127½	-½
245,500	Dec. 13	5	5	Do. 5 p.c. Red. Pref. ...	99—104	...
306,083	July 1	4	4	Do. 4 p.c. Deb. ...	102—104	...
106,280	Aug. 9	10	10	Preston 'A' 10 p.c.	206—216	...
188,219	,,	7	7	Do. 'B' 7 p.c.	147—157	...

NEWCASTLE EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations, Jan. 14.	Rise or Fall on Week.
122,577	Aug. 9	8	8	Blyth 5 p.c. Ord.	165—166	...
732,000	Aug. 9	5	5	Hartlepool G. & W. Cn. & New	112—114	...
2,061,315	Aug. 9	5⅝	5	Newcastle & Gateshead Con.	23/3—23/9a	...
682,856	,,	4	4	Do. 4 p.c. Pref. ...	98—100	...
776,706	Jan. 3	3½	3½	Do. 3½ p.c. Deb. ...	89½—90½*	...
277,285	Nov. 1	5	5	Do. 5 p.c. Deb. '43...	103—105	...
332,351	Aug. 23	6	6	Sunderland 6 p.c. max. ...	140—142	+1

NOTTINGHAM EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations, Jan. 14.	Rise or Fall on Week.
542,270	Aug. 9	9	6	Derby Con.	135—145	...
55,000	Dec. 13	4	4	Do. 4 p.c. Deb.	100—105	...
20,000	Dec. 13	5	5	Long Eaton 5 p.c. Pref. ...	10—12	...
80,000	,,	5	5	Do. 5 p.c. Deb. ...	105—110	...

SHEFFIELD EXCHANGE

Issue. £	When ex-Dividend.	Dividends. Prev. Hf. Yr. % p.a.	Dividends. Last Hf. Yr. % p.a.	NAME.	Quotations, Jan. 14.	Rise or Fall on Week.
10,000	Sept. 20	10	10	Great Grimsby 'A' Ord. ...	210—220	...
6,500	,,	10	10	Do. 'B' Ord. ...	210—220	...
79,000	,,	10	10	Do. 'C' Ord. ...	205—210	...
1,806,339	Aug. 23	6	6½	Sheffield Cons.	144—148	...
95,000	Jan. 3	4	4	Do. 4 p.c. Deb.	100—103*	...

a The quotation is per £1 of Stock. b Actual for Quarter. c Actual. * Ex div.

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